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Birds in Wales
Adar yng Nghymru

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Edited by Rhion Pritchard

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Editorial

This year we have papers on two species which seldom feature in Birds in Wales, a paper on Shelduck in the Milford Haven Waterway and Daugleddau Estuary of Pembrokeshire by Jane Hodges, and a paper on the Ring-necked Parakeet in Wales by Richard Facey and James Vafidis. We also have a review of the first twenty years of the Newport Wetlands National Nature Reserve by Tom Dalrymple. During that period, the reserve has developed into one of the finest in Wales, with the breeding birds including Avocet and Bittern. There is also a paper by me on the prehistoric and historic bird fauna of Wales, an introduction to what can be learned about the past bird fauna of Wales from archaeological records, place names and literary references, and a paper on population estimates for birds in Wales by Julian Hughes, Ian Spence and Simon Gillings.

As the journal was being prepared for the printer, news came in of the sad death of Peter Hope Jones, who made a huge contribution to Welsh ornithology. An obituary by Geoff Gibbs is included in this issue.

Thanks to everyone who acted as referees for the various papers or who helped in other ways; they are named in the individual papers. I thank Ian Spence for his help with the layout and cover of this and previous issues of our journal. Thanks to Kelvin Jones for taking responsibility for the photographs, and to the photographers, credited individually for each photograph, for permission to use their work.

We need papers for next year's issue of Birds in Wales. If you have any ideas for papers dealing with any aspect of ornithology in Wales, please get in touch with me to discuss them. Any papers to be included in the 2021 issue will need to be submitted by early April next year.

Rhion Pritchard

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Annual surveillance of summer Shelduck populations in the Milford Haven Waterway and Daugleddau Estuary, Pembrokeshire

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Crynodeb

Mae Aberdaugleddau yn Sir Benfro yn dal niferoedd o bwysigrwydd rhanbarthol o Hwyaden yr Eithin (Tadorna tadorna) yn ystod misoedd y gaeaf. Ceir hefyd boblogaeth fechan o adar sy'n nythu ac adar heb fod yn nythu, sydd wedi bod yn destun arolygaeth flynyddol rhwng 1992 a 2019, fel rhan o raglen arolygu'r amgylchedd a gydlynir gan Grŵp Arolygu Amgylcheddol Dyfrffordd Aberdaugleddau.

Disgrifir nod ac amcanion, dulliau a chanlyniadau'r arolygon blynyddol dros gyfnod o 28 mlynedd yn y papur yma. Awgryma'r data fod maint y boblogaeth sy'n nythu wedi amrywio yn ystod y cyfnod rhwng 1992 a 2019: cofnodwyd cynnydd yn y nifer o nytheidiau rhwng 1992 a chanol neu ddiwedd y 1990au, yna gostyngiad yn y nifer cyn cynnydd eto o 2014 ymlaen. Roedd cyfartaledd maint y nytheidiau hefyd yn amrywio yn ystod y cyfnod. Gwelwyd amrywiaeth hefyd yn nifer yr Hwyaid yr Eithin nad oeddynt yn nythu, ond o ddechrau'r 2000au ymlaen, ymddengys ei fod yn tueddu i ostwng.

Nodir a thrafodir yn fyr rai o'r ffactorau allanol a lleol a allai fod wedi dylanwadu ar y tueddiadau yn y boblogaeth Hwyaid yr Eithin yn Aberdaugleddau rhwng 1992 a 2019.

Summary

The Milford Haven Waterway and Daugleddau Estuary in Pembrokeshire hold regionally important numbers of Shelducks during the winter months. There is also a small summer breeding and non-breeding population that has been the subject of annual surveillance between 1992 and 2019, as part of an environmental surveillance programme co-ordinated by the Milford Haven Waterway Environmental Surveillance Group.

The aims and objectives, methods and results of the annual surveillance carried out over a period of 28 years are described in this paper. The data suggest that between 1992 and 2019, the size of the breeding population fluctuated: an increase in the numbers of broods was recorded between 1992 and the mid-late 1990s, followed by a decline and then another increase from 2014 onwards. The mean size of broods also varied during this period. The numbers of non-breeding Shelducks recorded during the spring have also varied although from the early 2000s onwards, the overall trend appears to have been downwards.

Some of the external and local factors that may have influenced the trends in summer Shelduck populations in the Milford Haven Waterway and Daugleddau Estuary between 1992 and 2019 are identified and briefly discussed.

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Introduction

The Milford Haven Waterway and Daugleddau Estuary (here-in after referred to as the estuary system) are a natural drowned valley (ria) system that stretches from the entrance to the Milford Haven Waterway at St Ann's Head to Haverfordwest on the Western Cleddau and Blackpool Mill on the Eastern Cleddau. The estuary system encompasses shallow bays such as Angle Bay, and pills and tributaries such as Sandy Haven, Cosheston Pill, Pembroke, Carew and Cresswell Rivers and The Gann Estuary. It forms part of the Pembrokeshire Marine Special Area of Conservation (SAC) and is a Site of Special Scientific Interest (SSSI), on account of a suite of intertidal and subtidal habitats and features of European and national importance.

During the autumn and winter months, the estuary system holds nationally important numbers of wetland birds, including Shelducks *Tadorna tadorna* which (until the 2000/01 winter) exceeded the threshold for national importance in their own right. Data from the Wetland Bird Survey (WeBS) counts during the 1999/2000 winter indicated that the estuary system held approximately 19% of the total Welsh population during that winter (Haycock 2000). Numbers of Shelducks over-wintering in the estuary system have, however, fallen in recent years and they no longer reach qualifying levels for national importance (Haycock 2019).

The Shelduck is one of the few species of wetland birds that regularly breed within the estuary system: the small summer breeding population was the subject of intermittent boat surveys during the 1960s and 1970s. Annual summer Shelduck surveys using a repeatable survey method were trialled in 1991 and full surveys have been carried out since 1992 (Hodges 1992-2019), as part of an annual environmental surveillance programme commissioned and co-ordinated by the Milford Haven Waterway Environmental Surveillance Group (see End Note).

The scope, aims and objectives, methods and results are described in this short paper. It concludes with a discussion of some of the factors that are likely to be influencing summer Shelduck populations in the estuary system.

Scope of the annual surveillance of summer Shelduck populations

All the major tributaries, pills and bays within the estuary system between the entrance to the Milford Haven Waterway at St Ann's Head and normal tidal limits on the Eastern and Western Cleddau (which together form the Daugleddau Estuary) that are accessible by boat were included in the annual surveillance of summer Shelduck populations (Figure 1). Also included were Westfield Pill, The Gann Estuary/Pickleridge Pools, the lower Pembroke Mill Pond and Carew Mill Pond, which were surveyed on foot (the two mill ponds were created as a result of historical impoundments on the Pembroke and Carew Rivers respectively and are considered to be part of the estuary system).

Aims, objectives and methods

The main aims and objectives of the annual surveillance of summer Shelduck populations were to:

- Locate and count pairs and territorial males without broods;
- Locate pairs or single adults with broods and ascertain the number of ducklings in each brood;
- Locate and count any non-breeding Shelducks present during the first survey in June and any recently fledged juveniles in the second survey, in July/early August.

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Figure 1. Areas included in the annual surveillance of summer Shelduck populations

The opportunity has also been taken to locate and estimate the numbers of any other wetland birds present in the estuary system during the surveys, although these additional data are not the subject of this paper.

The annual surveillance of summer Shelduck populations between 1992 (the first year of full surveys) and 2019 has been carried out via a combination of boat and land-based surveys. In the early years, the Pembrokeshire Coast National Park Authority (PCNPA) made available its Water Ranger patrol boat crewed by PCNPA's Water Ranger for the surveys. Latterly, the Port of Milford Haven (which took over the Water Ranger project in 2012 following a period of joint management between the Port and PCNPA) made its Water Ranger Patrol Boat (currently an 8m Humber Ocean Pro-Rigid-Hulled Inflatable Boat) crewed by the Port of Milford Haven Water Ranger and Assistant Water Ranger available for the surveys.

The surveys were generally carried out in mid-June and mid-July although in some years, the second survey was carried out in late July/early August. The dates and timings of the surveys were dictated by the requirement for rising spring tides that enabled boat access to most of the areas within the estuary system included in the annual surveillance programme. Where boat access was not possible, surveys were carried out on foot using the standard methods that are used to conduct the winter WeBS counts. These were generally carried out on a falling tide which permits access to the foreshore and to strategic view-points. A log was kept of the surveys and all sightings of Shelducks and other wetland birds were marked onto 1:25,000 scale OS base maps (data collected for other wetland birds were subsequently passed on to the local WeBS Co-ordinator).

The following data were collected during the boat and land-based surveys:

June

- Locations of pairs or single adults with broods;
- Numbers of ducklings in each brood;
- Locations and numbers of territorial males without broods;
- Locations and numbers of non-breeding Shelducks;
- Locations and numbers of all other wetland birds present during the surveys.

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July/early August

- Locations of pairs or single adults with (late) broods;
- Numbers of ducklings in each brood;
- Locations and numbers of surviving ducklings (from the first round) and recently-fledged (juvenile) Shelducks;
- Locations and numbers of all other wetland birds present.

The pairs without broods recorded during the June survey were likely to have failed or were late in their breeding attempts (in the latter case, broods would be likely to have been picked up and recorded as new broods in the second survey in July/early August). Single males occupying territories (which include foraging areas) on the foreshore in June may have had females sitting on nests away from the foreshore. Pairs without broods and single (territorial) males were therefore treated as part of the breeding population, as distinct from any non-breeding Shelducks that were present (usually in groups) in June. By the second survey in July/early August, non-breeding Shelducks, together with adults without broods had (usually) left the estuary system, and were presumed to be en route to the annual moult grounds.

During the surveys, a careful note was made of any movements of birds up or down, or between different parts of the estuary system in order to avoid double-counting. Disturbance was kept to a minimum through, for example careful and considerate boat-handling by very experienced crews with a detailed knowledge of the estuary system.

Results

Distribution of Shelducks in the estuary system

Shelducks with broods were recorded in most parts of the estuary system between 1992 and 2019. In terms of the frequency and numbers of broods seen, the most important parts of the estuary system during this period include the Western and Eastern Cleddau, the Carew and Cresswell Rivers and Pembroke River (Figure 1). Up to four broods have been recorded in each of these areas annually. In other parts of the estuary system such as Cosheston Pill and Sandy Haven, broods have only been recorded on an occasional basis.

Broods were seen fairly regularly in Angle Bay in the 1990s however, by the early 2000s, Shelducks had disappeared as a breeding species from this part of the estuary system. Broods were also seen on an almost annual basis in Westfield Pill until the year 2000, since when there have been no sightings of broods in this part of the estuary system. Shelducks (as a breeding species) also appear to be absent during the spring and summer from other parts of the estuary system such as Llangwm and Garron Pills.

Pairs without broods (which may have already failed in their attempts to breed by the time of the first survey in mid-June) and single territorial males have also been recorded in most of the principal tributary rivers and pills during the same period.

In addition to the breeding population, non-breeding Shelducks were recorded in the estuary system during the first survey in late June. The majority of these birds were seen in areas such as the Western Cleddau, Eastern Cleddau, Carew and Cresswell Rivers and Pembroke River. Small flocks have also been observed in other parts of the estuary system such as Millin and Sprinkle Pills (which are tributaries of the Western Cleddau), Cosheston Pill and Angle Bay, although on a more irregular basis.

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Breeding population size

Figure 2 shows the total number of broods seen during the surveys between 1992 and 2019.

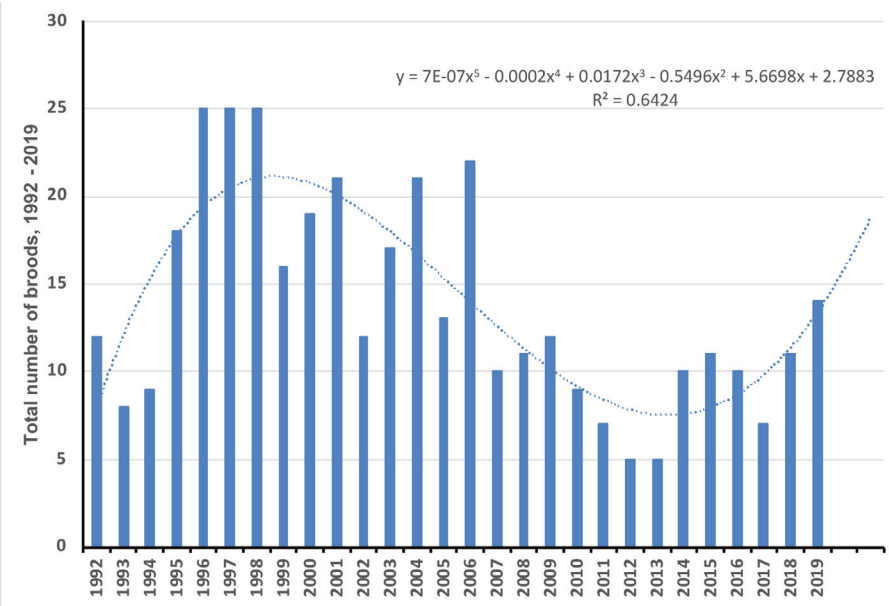

Figure 2. Total number of broods recorded 1992-2019

The trend line in Figure 2 (R^2 value = 0.64) suggests that the total number of broods recorded each year from the commencement of the annual surveillance project in 1992 to the mid-late 1990s increased from 12 to a peak of 25. After 1998, the numbers of broods gradually declined and reached the lowest numbers recorded to date in 2012 and 2013 (five broods in both years). The springs and summers of both these years were particularly cold and wet. Figure 2 also suggests that the numbers of broods are currently on an upward trend: a total of 14 broods were recorded in 2019 which was the best year (in terms of the numbers of broods seen in the estuary system) since 2006.

Brood sizes

Figure 3 (below) shows the average brood sizes recorded in the estuary system between 1992 and 2019.

The mean brood size has varied between years, ranging from 3.2 ducklings per pair (recorded in 2012) to 8.9 ducklings per pair in 2017. Figure 3 suggests that mean brood sizes tended to be higher in the early 1990s, although from the mid-1990s to *c*.2010, there was a steady decline in the mean size of broods followed by an increase in brood sizes, peaking in 2017 (R^2 = 0.52).

The numbers of ducklings in each brood recorded during the surveillance period ranged from 1 to as many as 20. Large broods of ducklings were more common in the 1990s than in recent years, with broods of 10 or more quite regularly recorded on e.g. the Western Cleddau, Eastern Cleddau, Cresswell, Carew and Pembroke Rivers. Shelducks lay on average 8-9 eggs (Cramp et al 1977); broods of 10 or more ducklings (in which all ducklings were of a similar size/age) may indicate "dump-nesting" whereby two or more females lay their eggs in the same nest, leaving the owner of that

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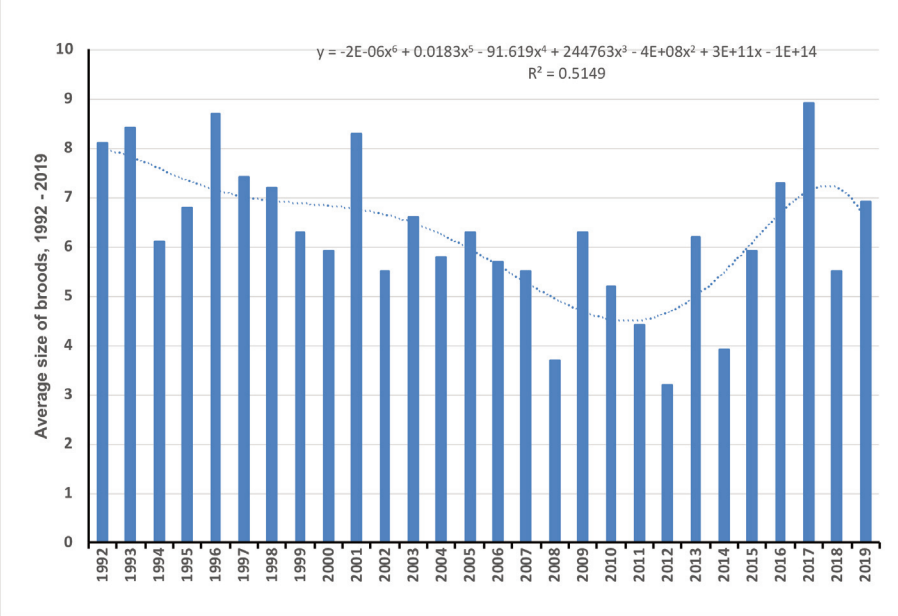

Figure 3. Mean size of broods recorded 1992-2019

nest to incubate all the eggs. Such behaviour may suggest competition for good nest sites, the level of which may vary between years depending on the numbers of pairs attempting to breed.

Broods comprising only one or two ducklings suggest either nest failure or that ducklings failed to make it to the water for example, as a result of predation. In some instances, it is also likely that small brood sizes were the result of ducklings being lost after reaching the water but before the surveys were carried out, again possibly due to predation.

The combined numbers of well-grown ducklings and recently fledged juveniles seen in the second surveys (the survivors of broods seen during the first surveys in June) varied between years, from just seven in 2002 and 2012 to 103 in 1997 (from 25 broods). Higher numbers of well-grown ducklings and juveniles from broods seen during June surveys were recorded during the 1990s than in the 2000s and 2010s.

Non-breeding population

The numbers of non-breeders recorded in June between 1992 and 2019 are shown in Figure 4.

Small flocks of non-breeding Shelducks have been recorded in several parts of the estuary system in June each year. These flocks are likely to have been predominantly birds that had spent the preceding winter in the estuary system, although they may also have included birds that may use the estuary as a stopping-off point during movements between wintering grounds elsewhere and their annual moult grounds.

The data shown in Figure 4 suggest that between 1992 and 2019, the numbers of non-breeders recorded during the surveys in June have varied considerably between years. The highest number of non-breeders recorded in the June surveys was 183 in 1998 which coincidentally followed the

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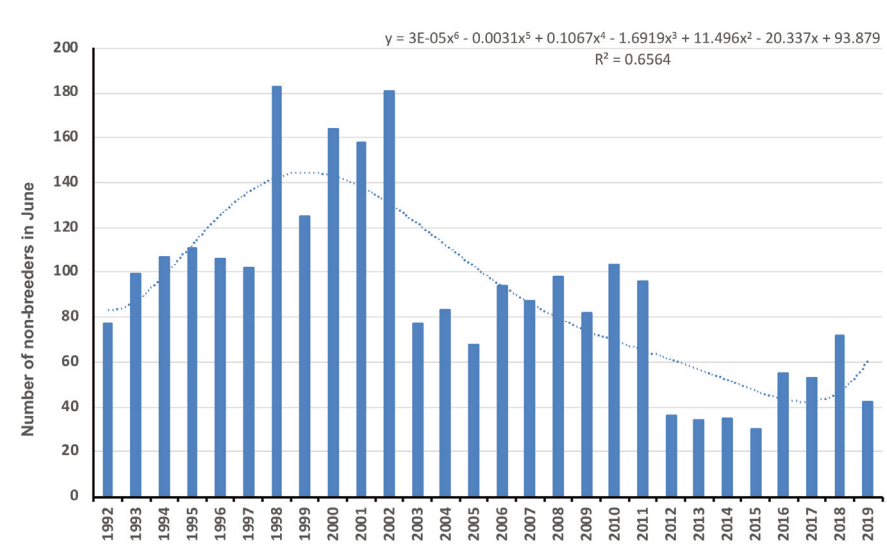

Figure 4. Numbers of non-breeders in June 1992-2019

second highest peak winter count recorded between the 1991/92 and 2018/19 winters. The lowest number of non-breeders seen during the June surveys was 30 in 2015. Although the numbers of non-breeders present in the estuary system in spring have fluctuated over the years, the overall trend appears to have been downwards since *c*.2001 (R^2 = 0.65).

Discussion

There are many external and local (site-based) factors acting alone or in combination that may have influenced the numbers of Shelducks that attempted to breed, the success (or failure) of breeding attempts and the number and size of broods that are subsequently seen on the water during the period covered by the annual surveillance. These include:

The number of Shelducks that winter in the estuary system. In the Milford Haven Waterway and Daugleddau Estuary, winter maxima tend to occur in January and February. In the 1980s, average peak counts exceeded 1,000 birds (it reached over 2000 birds in the 1987/88 winter). During the 1990s, winter maxima dropped to less than 700 birds. The decline in the wintering population in the estuary system continued through the 2000s (by which-time, the number of over-wintering Shelducks in the estuary system had fallen below the qualifying level for national importance for this species) and has been below 500 since the 2013/14 winter. The numbers of Shelducks recorded during the 2015/16 winter peaked at 264, the lowest winter peak count in the estuary system since 1992 (A. Haycock pers. comm. 2020).

WeBS data for the UK as a whole suggest that since the 2013/14 winter, there have been signs of an up-turn in the trend in the numbers of Shelducks overwintering in the UK (Haycock 2018; Frost *et al*. 2019). This tends to suggest that the decline in the numbers of Shelducks overwintering in this estuary system have been more pronounced in the past four to five years than in the UK as a whole. The reasons for this are not clear, although external factors such as changes in annual moult grounds may have played a part. Analysis of the data obtained on summer Shelduck populations in

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the estuary system carried out as part of a review of the annual surveillance programme commissioned by the MHWESG has however, shown a moderate correlation between the number of adult Shelducks recorded during the breeding season and the population trends at the Wales/UK level picked up by WeBS. This suggests that the trend may have reflected changes at a wider (i.e. regional/national) level rather than site-specific impacts (Green *et al*. in prep.).

Adverse weather conditions. Heavy rain and low temperatures could contribute to the loss of eggs and newly-hatched ducklings which are potentially vulnerable to chilling/water-logging if left unattended (e.g. as a result of disturbance at the nest). Although they are known to nest in (or even under) buildings, in trees and other structures above the ground, Shelducks usually nest on the ground e.g. in old rabbit burrows, under dense patches of scrub and even in artificial structures such as culverts and covered drains (Cramp *et al*. 1977). Nests on the ground are at risk from flooding during periods of intense rainfall. In 2012, the number of broods seen on the estuary and the average brood size were the lowest since the annual surveillance began in 1992. The spring and summer that year were particularly cold and very wet: the relentlessly bad weather may (at least in part) help to explain the very poor outcome of the breeding season.

Disturbance from water-borne activities. Recreational boating and other water-borne activities have the potential to contribute to losses of ducklings e.g. by causing the scattering of broods thereby exposing individual ducklings to a higher risk of predation. No incidents of disturbance of Shelducks as a direct result of recreational activities on the water have been observed during the surveys, and none have been reported (B. MacFarlane pers. comm.). The relative insignificance of recreational

Shelduck (Bob Garrett)

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disturbance may be due (at least in part) to the designation (in the late 1970s) of the most sensitive parts of the estuary system (including all the areas that are important for Shelducks) as Dead Slow Minimum Wake areas by the Port of Milford Haven. The purpose of the designation of these areas is to help ensure navigational safety; to protect wildlife from disturbance and to avoid damage to estuary habitats (Port of Milford Haven 2020). Enforcement of the speed restrictions that apply within the designated areas has been carried out by the Water Ranger since 1992.

Predation. Predation is likely to have been the most significant factor affecting the numbers and sizes of broods seen in the estuary system. Ground predators such as Foxes *Vulpes vulpes* and Rats *Rattus norvegicus* are likely to be responsible for the predation of eggs and ducklings in the nests, and are likely to have a significant impact on the numbers of ducklings that make it from the nest to the water. The locations of nest sites are not known, although they can be some distance from the estuary. Ducklings (led by their parents) can face quite a trek from their nests to the (relative) safety of the water: some broods have to negotiate roads and other hazards in addition to avoiding predators whilst attempting to reach the water (pers. obs.; R. J. Haycock pers. comm.). By the time they reach the water, some broods may already have been depleted or perhaps lost altogether as a result of predation.

Once on the water, predation is likely to be a major factor in the survival of ducklings to fledging. Otters *Lutra lutra*, together with avian predators such as Herring Gulls *Larus argentatus* and Lesser Black-Backed Gulls *L. fuscus* are chief among the suspects. On one occasion during the 2019 surveys, two Herring Gulls were watched working as a "pair" to distract the adults whilst scattering the brood in order to make it easier to "pick off" individual ducklings. Although they failed on that occasion, gulls have been observed successfully grabbing ducklings from the surface of the water during the surveys (pers. obs.). Predation of adults is also known to occur. Foxes patrol the foreshore and there has been at least one instance of a Fox taking an adult female Shelduck witnessed during the surveys (pers. obs.).

The formation of creches (whereby broods are amalgamated and are guarded by "baby-sitters" that delay their departure for the moult grounds for this purpose) is not often observed on this estuary system: perhaps broods are too few and scattered to trigger this behaviour (which among other things, could be a defence mechanism against predators).

Extent and quality of foraging habitat. Key factors in the size and productivity of the breeding population are the extent and quality of foraging habitat, which also sustains the over-wintering population. Shelducks are at the top of their food chain and a consistently poor breeding performance could indicate a decline in in the extent and/or quality of their favoured foraging habitat and food. In north-western Europe, the diet of Shelducks is dominated by the mud snail *Peringia (Hydrobia) ulvae* which is typically sieved from or just below the surface of slightly "sloppy" mud (Cramp et al 1977; Viain et al 2011).

There have been no major losses of foraging habitat in the estuary system in recent years, although minor losses may have occurred in one or two places. There may also have been localised changes in the substrate that could affect the distribution of mud snails, however, there is no evidence to suggest that this has occurred. If there have been any changes, they are likely to have been on a small scale with no significant effects on food distribution and availability.

Other factors that could influence the quality of the foraging habitat include acute and chronic pollution derived from e.g. the accumulation of contaminants in the sediments. Pollution could potentially affect the abundance and distribution of food and also the health of bio-accumulators such as Shelducks. One of the most recent (and largest) acute pollution incidents to have affected the estuary system was the Sea Empress oil spill which occurred at the entrance to the Milford

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Haven Waterway on 16th February 1996. During the spill, oil was stranded on the upper shores in the Milford Haven Waterway, in Angle Bay and in Pembroke River, both of which held wintering Shelducks at the time of the spill (Sea Empress Environmental Evaluation Committee 1998). Post-spill monitoring showed that relatively few Shelducks showed any obvious signs (e.g. oil on feathers and bare parts) that they had been affected by the oil: most simply moved away from or avoided oiled areas. The 1996 breeding season that followed was one of the three most successful between 1992 and 2019 in terms of the number of broods recorded, suggesting that the oil spill had no effect on the breeding population.

Current evidence of the environmental health of the estuary system indicates that the estuarine waters are nutrient-enriched (by dissolved organic nitrogen in particular), and the dense growths of opportunistic macro-algae e.g. *Ulva* species that are present throughout the estuary system are linked to nutrient enrichment (Natural Resources Wales 2016). This evidence also suggests that there is a high level of anoxia in surface sediments beneath the dense algal mats that blanket the intertidal mudflats where Shelducks forage for food. Monitoring carried out in 2007, 2012, 2015 and 2018 in the intertidal areas revealed that mud snails continue to be widely distributed and abundant in the estuary system (M. Camplin pers. comm. 2019). Where there were dense blankets of algae, mud snails migrated into the algal mats possibly in response to the anoxic conditions that had developed beneath the mats.

The remobilisation of estuarine sediments could result in localised changes to sediment characteristics which in turn could affect the distribution of and accessibility of food to Shelducks. It is possible (but not proven) that bioaccumulation of remobilised contaminants could also affect adult breeding performance and the survival and development of ducklings. Although a drop in the number of broods seen in the estuary system occurred within a year or so of high levels of dredging activity (Little *et al*. 2015), no causal relationship has been established.

It is not known whether factors such as changes in the nutrient status of the estuary system have had any effect on the summer Shelduck populations. Analysis of the data on the numbers of broods and ducklings recorded during the period covered by the annual surveillance showed, however, that both are strongly correlated with the total number of adults recorded. This suggests that the variation in the numbers and sizes of broods between years is linked to changes in the adult population rather than to any site-specific pressures affecting productivity (Green *et al*. in prep.).

Concluding remarks

Shelduck populations in the autumn and winter are well-documented by the WeBS however, breeding Shelducks are poorly represented in local and national monitoring schemes (such the BTO's Breeding Birds Survey) (Green *et al*. in prep.). As a consequence, the status of Shelduck as a breeding species in Wales is not well understood. The annual surveillance of summer Shelduck populations in the Milford Haven Waterway and Daugleddau Estuary between 1992 and 2019 has provided a useful insight into the dynamics of a small breeding and non-breeding population of Shelducks that may help to increase our understanding of what may be happening in the Welsh breeding population as a whole.

Shelducks are at the top of their food-chain and as such, they are potentially useful indicators of environmental change. Although data analysis has shown that the links between variations in the size of the breeding and non-breeding population and productivity are to external rather than site-specific factors, future trends may signal environmental changes within the estuary system that may warrant investigation.

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Acknowledgements

The annual surveillance of the summer Shelduck populations in the Milford Haven Waterway and Daugleddau Estuary since 1992 has been made possible by the availability of suitable boats and crew. Thanks to Neville Hopkins who made his boat available for the trial run in 1991, and to PCNPA and the Port of Milford Haven for making available their Water Ranger patrol boats and personnel for the surveys between 1992 and 2019. Thanks to Annie Haycock (Pembrokeshire WeBS Co-ordinator) for providing information on wetland birds in the estuary system during the winter; to Alan Hanson, Graham Rees, the late Jack Donovan, Anne Bunker, Annie Haycock, Bob Haycock, Brian MacFarlane and Sarah Mellor for additional observations and records of Shelducks in the estuary system; to Anne Bunker and Mike Camplin (NRW) for information on the distribution of macro-algal mats and *Peringia ulvae* in the estuary system and to Brian MacFarlane for information on the Water Ranger project and on recreation in the Milford Haven Waterway.

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End Note

The Milford Haven Waterway Environmental Surveillance Group is a collaborative group of statutory bodies, industry and others with an interest in the environmental quality of the Milford Haven Waterway. The Group's purposes include the provision of high-quality environmental information and to contribute to the maintenance, enhancement and safeguard of the Waterway's rich and diverse marine environment (**https://www.mhwesg.org.uk**) The Group maintains an annual programme of surveillance of the marine physical and chemical environment, marine biology and ornithology in the Milford Haven Waterway and Daugleddau Estuary, from a line between St Ann's Head and Sheep Island at the entrance to the Waterway to the upper tidal limits of the Eastern and Western Cleddau Rivers.

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The prehistoric and historic bird fauna of Wales: evidence from archaeology, literature and place names.

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Crynodeb

Ychydig iawn o wybodaeth sydd i'w gael am adar Cymru mewn llyfrau printiedig cyn yr 17eg ganrif, ond mae tystiolaeth ar gael o gloddio archeolegol, o enwau lleoedd ac o amrywiaeth o lawysgrifau, yn enwedig barddoniaeth. Ymddengys fod rhai rhywogaethau nad ydynt yn nythu yng Nghymru heddiw, er enghraifft Eryr y Môr (Haliaeetus albicilla), wedi bod yn weddol gyffredin ar rai adegau yn y gorffennol.

Summary

Though the information available from printed books about the avifauna of Wales is very scanty before the 17th century, evidence is available from bird remains found in archaeological excavations, from place names and from a variety of manuscripts, primarily poetry. Some species which do not now breed in Wales, for example the White-tailed Eagle (Haliaeetus albicilla), appear to have been fairly common in Wales in the past.

Introduction

There is comparatively little information available about birds in Wales in publications either specifically dealing with birds or dealing with wildlife in general before the nineteenth century. George Owen's The Description of Penbrokshire [sic.] of 1603 included a list of the county's birds with comments on their status, and this appears to be the first work to do more than mention some bird species individually. Information on the bird life of Wales before this period can be derived from several sources, including archaeological finds, poetry and various prose texts. Place names can also provide valuable information, though they need to be approached with some care. This paper aims to outline what information is available, concentrating on species whose status may have changed in Wales.

Sources of Information

Archaeology

Bird remains have been found at many archaeological sites in Wales, including some dating from the warm interglacial Ipswichian period, beginning about 130,000 years ago, at Bacon Hole and Minchin Hole on the Gower peninsula. This period was followed by the colder Devensian period, also known as the Last Glacial Period. This began about 120,000 years ago and at times saw the ice cap spread south almost to the southern coast of Wales, though there were also more temperate periods. The Devensian period ended about 11,700 years ago. More recent archaeological sites are usually referred to by archaeological periods, including the Mesolithic era which began about 12,000 years ago, followed by the Neolithic era from about 6,000 years ago.

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Bones, particularly the fragile bones of small bird species, are not well preserved in acid conditions, which prevail in many parts of Wales, and most finds come from limestone caves (Lynch *et al*. 2000). The majority of the finds of bird bones come from caves on the south coast of Wales, on the Gower peninsula and to a lesser extent in Pembrokeshire. Changes in the climate were reflected in changes in the avifauna, though it is often not clear from the finds whether migratory species were breeding or wintering in the area or were passage migrants. Occasionally, incomplete ossification of the bones indicates the presence of young birds. Distinguishing between the bones of some similar species of bird can be difficult, though remains found at many sites have been preserved in collections, and the identification later re-checked. Misidentification of bones is however a possibility that must be considered. There is also the possibility of bones being buried by a mammalian predator, and consequently being found among items from an earlier period. At sites dating from the Roman period onwards, some species might have been brought to the site from a distance by humans, for eating or for other purposes.

The largest assemblage of bird bones yet found in Wales came from Port Eynon Point Cave on the Gower peninsula, where 43 species were identified in deposits thought to date from between 9,000 and 6,000 years ago, immediately after the last glaciation (Harrison 1987). Many of these were species which a birdwatcher might expect to see on the Gower today, but there were others, such as Great Bustard (*Otis tarda*), which would cause considerable surprise if seen in the area now. Bones identified as Junglefowl (*Gallus sp).* were considered by authors such as Yalden and Albarella (2009) to be probably intrusive (the remains of someone's lunchtime chicken?), but Harrison thought that that they might indicate the presence of an extinct European Junglefowl species, commonly thought to have died out by the last glaciation.

Poetry

There are many references to birds in Welsh poetry from an early period. Many of the earliest references are to Ravens (*Corvus corax*), and sometimes eagles, feeding on the corpses of the slain after a battle. Later on, a greater interest in nature, particularly in 14th century poets such as Dafydd ap Gwilym (fl. 1320 – 70), resulted to references to a wide variety of birds in other contexts. Williams (2014) showed that four bird species were mentioned more frequently in the poetry of this period than any others: the Song Thrush (*Turdus philomelos*), the Blackbird (*Turdus merula*), the Cuckoo (*Cuculus canorus*) and the Nightingale(*Luscinia megarhynchos*). The first three are still common in Wales today, while the Nightingale is now a scarce vagrant, and may never have been a common bird in most of Wales.

While some poets had an interest in birds for their own sake, others mentioned them mainly for their utility to humans, either in falconry or as an item on the menu. The many references to raptors are usually in the context of falconry, thus Peregrine (*Falco peregrinus*) and Goshawk (*Accipiter gentilis*) are frequently mentioned but there are very few references to the Buzzard (*Buteo buteo*), which was of little value as a falconer's bird, even though it was presumably fairly common. There are more references to the Red Kite (*Milvus milvus*), but usually uncomplimentary ones referring to its role as a scavenger (Williams 2014).

Prose

There are some references to birds in legal texts. The Welsh Laws were traditionally codified by Hywel Dda (c.880-950), who eventually came to rule most of Wales. There are no surviving texts from this period; the earliest extant texts date to around the early 13th century, though earlier material was incorporated in them. These texts cannot be used to make deductions about the 10th century fauna of Wales. Legal texts were working documents, revised to reflect changes in the law, so legislation described in the Welsh law texts cannot be taken as evidence of either the law or the

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fauna of earlier periods. The Domesday Book of 1086 has a number of references to hawk's nests or *airae accipitru*, including four in North Wales; Yalden and Albarella (2009) considered that these must have been references to Goshawks rather than Sparrowhawks (*Accipiter nisus*). There are also a few mentions of bird species in other sources, such as Giraldus Cambrensis, whose journey through Wales in 1188 in the company of the Archbishop of Canterbury to recruit for the Third Crusade is recorded in his Itinerarium Cambriae.

Place names

Not all place names date back to an early period, but it is likely that most topographical names, of features such as mountains, hills and cliffs, are of considerable antiquity. They can therefore provide valuable information about the distribution of at least some bird species. Places tend to be named after large and impressive species, eagles and Raven rather than Dunnock (*Prunella modularis*) for example. The Nightingale is an exception, presumably because of its cultural significance. There are some potential pitfalls, for example the same name could be applied to different species of bird. Garan was usually used for Crane (*Grus grus*) but sometimes for Grey Heron (*Ardea cinerea)*, and therefore the element garan in place names cannot safely be taken to indicate the presence of Cranes. The same is true of manuscripts unless the Grey Heron is also mentioned in the document under another name.

Timeline for archaeological finds

The approximate dates, in Years Before Present (BP) of the periods to which finds of bird remains in Wales have been allocated are as follows (note that there is some overlap):

Period	Years Before Present (BP)
Ipswichian	115,000 - 130,000
Devensian (Last Glacial Period)	12,000 - 115,000
Upper Palaeolithic	12,000 -40,000
Mesolithic	6,000 -12,000
Neolithic	3,800 – 6,000
Bronze Age	2,800 – 3,800
Iron Age	From 2,800

Systematic list of bird species

Most early records of bird species, whether in archaeological finds, poetry or place names, are of species which are still common or fairly common in Wales today. This list concentrates on species whose status may have changed in Wales.

Black Grouse *Lyrurus tetrix* Grugiar Ddu

Remains were found at Little Hoyle cave, Pembrokeshire, probably from the late Devensian or early Mesolithic period (Eastham 2016). A 14th century poem Y Ceiliog Du ("The Blackcock"), usually attributed to Dafydd ap Gwilym, though it has been suggested on stylistic grounds that he is not the author, has a detailed description of the bird. The location is not mentioned.

Capercaillie *Tetrao urogallus* Grugiar Coed

Despite considerable speculation, there appears to be no proof that this species ever bred in Wales.

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No remains have been found at archaeological sites. There are a number of references by poets and other authors to Ceiliog y Coed (Cock of the Woods), and Ceiliog y Coed is included in the manuscript Y naw helwriaeth (The nine huntings), thought to date from the mid-16th century (Linnard 1984). Pennant, both in his British Zoology (1768) and in Tours in Wales (1781), considered that this was the Capercaillie, and several more recent authors such as Matheson (1932) and Peate (1934) have concurred. Linnard (1984) however thought that the Ceiliog y Coed reference in Y naw helwriaeth was to the Black Grouse, while Lewis and Salisbury (2007) considered that in Welsh poetry Ceiliog Coed was usually an alternative name for Common Pheasant.

Pheasant *Phasianus colchicus* Ffesant
The earliest record from Wales is of remains found at Hen Domen, Montgomeryshire, dating from the early Norman era, probably early 12th century (Browne 2000). It is uncertain when this species was introduced to Britain; a few records from England suggest that some birds were present in Britain in Roman times (Yalden and Albarella 2009), but these may not have been wild.

Barnacle Goose *Branta leucopsis* Gŵydd Wyran
Bones of this species found at Little Hoyle, Pembrokeshire, dated at about 22,800 years ago, were considered by Lynch *et al*. (2000) to be from a breeding population during a climatic downturn. Bones were also found at Hoyle's Mouth nearby. However, Eastham (2016) noted that several species of the *Anser* family were also represented, including Pink-footed Goose (*Anser brachyrhyncos*), White-fronted Goose (*Anser albifrons*) and Lesser White-fronted Goose (*Anser erythropus*). Since each of these now occupies a different habitat in the Arctic during the breeding season, Eastham suggested that they would only be found together on migration or at a winter refuge.

Lesser White-fronted Goose *Anser erythropus* Gŵydd Dalcen-wen Leiaf
Remains were found at Hoyle and Little Hoyle caves, Pembrokeshire, dating from the Mesolithic era, 9,000 to 6,000 years ago (Eastham 2016).

Mute Swan *Cygnus olor* Alarch Dôf
Rather surprisingly, no remains of Mute Swan have been found at archaeological sites in Wales, although finds are widespread in England (Yalden and Albarella 2009). There are many references in medieval Welsh poetry, reflecting the importance of the species as a dish for banquets in that period. It is likely that someone claimed ownership of every swan in Wales in the medieval period, though the birds were not confined, and were probably only fed in severe weather (Williams 2014). This is reflected in the Welsh name, which means "Domesticated Swan". Tudur Aled (*c*.1465 – 1525) claimed in one poem that the resources available to the kitchen at Plas-isa, Llanrwst, Denbighshire, included 120 swans (Williams 2014).

Bewick's Swan *Cygnus columbianus* Alarch Bewick
Bones found at Cat's Hole, Gower, date from the Devensian period, a colder period which included the last glaciation. Mammal remains at the site indicate a cold climate, and as Bewick's Swan is a cold-climate tundra-breeding species, it might well have been breeding in the area in this period (Harrison 1987b).

Great Bustard *Otis tarda* Ceiliog Mwyaf y Waun
Remains were found at Port Eynon Cave, Gower, dating from the Mesolithic era. This is one of only five records from Britain (Yalden and Albarella 2009).

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Common Crane *Grus grus* Garan
Analysis of bird footprints preserved in intertidal mud on the Severn Estuary at Goldcliff East, Gwent, dating from the Late Mesolithic period, around 7,000 years ago, showed that 46% of the bird footprints were those of Common Crane (Barr 2018), suggesting that this must have been a common bird in the area at that time. Remains of Crane have been found at a number of sites in Wales, including a Bronze Age record at Caldicott, Gwent, several records at Roman-era sites, including Pentre Farm, Flintshire and the legionary fortress at Caerleon, Gwent, and one early Norman era record of remains at Hen Domen, Montgomeryshire . A Crane skull found at Caerleon had the back of the braincase removed, a method mentioned in Roman cookery manuals (Yalden and Albarella 2009). Examples of Garan being used as a name for the Grey Heron mean that any references in written sources have to be interpreted with caution unless Grey Heron is also mentioned under another name. In some versions of the Welsh laws, the Crane is included among the "three notable birds" as a quarry for falconers. If a bird flown by the king's falconer brought down one of these three species, the king was obliged to honour the falconer in specific ways (Charles-Edwards *et a*l. 2000). There are also a few references in poetry indicating that the Crane was valued for eating in medieval times (Williams 2014). There are a good number of place names including the element Garan, but some of these could refer to Grey Heron. There are also several place names with English or Old Norse names for Crane in Pembrokeshire and the Gower peninsula (Yalden and Albarella 2009).

Avocet *Recurvirostra avosetta* Cambig
A Roman-era record from Caerleon, Gwent, is one of only two archaeological records from Britain (O'Connor 1986).

Cory's Shearwater *Calonectris borealis* Aderyn-Drycin Cory
Remains of this species were found at Bacon Hole Cave, Gower, dating to the Ipswichian interglacial period, around 125,000 years ago, and were thought by Harrison (1987b) to suggest breeding. This is the only archaeological record of Cory's Shearwater in Britain. The species now breeds well to the south, on Atlantic islands from the Cape Verdes to Madeira, and in the Mediterranean. Parts of the Ipswichian interglacial saw periods when the climate was considerably warmer than it is today, so it is perfectly possible that the bird was breeding in the area, though it could also have been a passage migrant blown onto the land by a gale.

Black Stork *Ciconia nigra* Ciconia Du
A piece of humerus from a large bird species found at Lynx Cave, Bryn Alun, Denbighshire, was eventually identified as that of a Black Stork by the Natural History Museum at Tring. The bone, which shows marks of butchering, was dated by carbon fourteen to about 2,945 years ago, in the mid to late Bronze Age (Blore 2016). This is one of only two finds of Black Stork remains in Britain (Yalden and Albarella 2009).

White Stork *Ciconia ciconia* Ciconia Gwyn
White Stork footprints have been found preserved in intertidal mud at Goldcliff East, Gwent, on the Severn Estuary, dating from the Late Mesolithic period, around 7,000 years ago. The small size of the footprints suggested they might have been made by a juvenile bird (Barr 2018). There appear to have been no finds of White Stork remains during archaeological excavations in Wales.

Bittern *Botaurus stellaris* Aderyn y Bwn
The Bittern is mentioned in the Welsh law texts as one of the "three notable birds" in falconry. Remains of Bittern were found at Hen Domen, Montgomeryshire, dating from the early Norman era (Browne 2000); it may be significant that another find at this site was the leg bone of a Goshawk

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showing a greenish tinge, which was thought to be the remains of a falconer's ring. A number of poems mention the Bittern as a target species in falconry (Williams 2014); one poem by Guto'r Glyn (*c*.1412 -*c*.1493) mentions hunting Bitterns with falcons on Anglesey. The Bittern was evidently one of the most prestigious quarry species for a falconer, probably because the secretive habits of the bird made it a difficult target. There are a few place names referring to the Bittern in Wales.

Golden Eagle *Aquila chrysaetos* Eryr Euraid

There are fewer records of this species at archaeological sites in Wales than there are of the White-tailed Eagle. Remains were discovered in Cathole Cave, Gower, and dated to the later Devensian period about 20,000 years ago (Yalden 2007), and Lovegrove *et al*. (1994) also mention remains found at Coygan Cave, Carmarthenshire. Giraldus Cambrensis recounts a tale during his journey through Wales in 1188 of an eagle which was said to perch on a particular crag in Snowdonia every fifth feast day, in anticipation of a war and the opportunity to feast on the corpses of the slain. There are a great many references to eagles in Welsh poetry; usually heroes or noblemen being compared to eagles (Williams 2014), but this type of reference cannot be taken as evidence of the presence of eagles in Wales.

Both in place names and in poetry, references to eagles are simply to Eryr, not specifying whether this was the Golden Eagle or the White-tailed Eagle. In a study of place names including "eagle" or corresponding forms in Britain, Evans *et al*. (2012) used the altitude and the environment in the area around the feature named to determine whether a place name was likely to refer to Golden or White-tailed Eagles. Of 18 place names they identified in Wales, twelve were considered likely to refer to the Golden Eagle and four to the White-tailed Eagle, with the other two uncertain. A search of the Melville Richards Place-name Archive and Ordnance Survey maps revealed that there are actually many more than 18 place names containing the element Eryr in Wales. A total of 78 place names were found, though many of these could not be used in the analysis. Reasons for excluding place names were:

(a) the place name could not be accurately located on an Ordnance Survey map;
(b) the name appeared likely to be a variant name for a feature already included in the analysis;
(c) the place name was likely to have been derived from another place name nearby, such as a wood probably named after a nearby crag;
(d) the place name appeared likely to be of recent origin;
(e) the name might not have referred to the bird. Eryri , the Welsh name for Snowdonia, is thought to be linked to an old word meaning "highland" rather than to the bird (Owen and Morgan 2007), and there are other place names which may derive from the same root.

After excluding these, there are 51 place names in Wales containing the element Eryr which appear to refer to the birds and do not appear to be derived from another place name. A similar study of place names by Williams *et al*. (2020) found 64 place names containing the element eryr which they considered valid.

Evans *et al*. (2012) noted that White-tailed Eagles and Golden Eagles breeding in western Scotland select nest sites with different characteristics. White-tailed Eagles tended to nest more often in trees, at lower altitudes and closer to water than Golden Eagles. The mean altitude of White-tailed Eagle nest sites was 67 ± 12m above sea level, compared with 231 ± 18m for Golden Eagle; all White-tailed Eagles nested below 150m compared with only 28% of Golden Eagles. Using the same criteria as those adopted by Evans *et al*. (2012), it can be concluded that 19 of the 51 place names identified in Wales probably refer to Golden Eagle and 22 probably refer to White-tailed Eagle; the remaining ten could refer to either species. Two place names include the word nyth (nest) as well as Eryr, and

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these both probably refer to Golden Eagle. It is worth noting that a number of crags whose name includes the element Cigfran still have Ravens breeding on them today, suggesting that it quite likely that many names including the element Eryr indicate sites where eagles formerly bred.

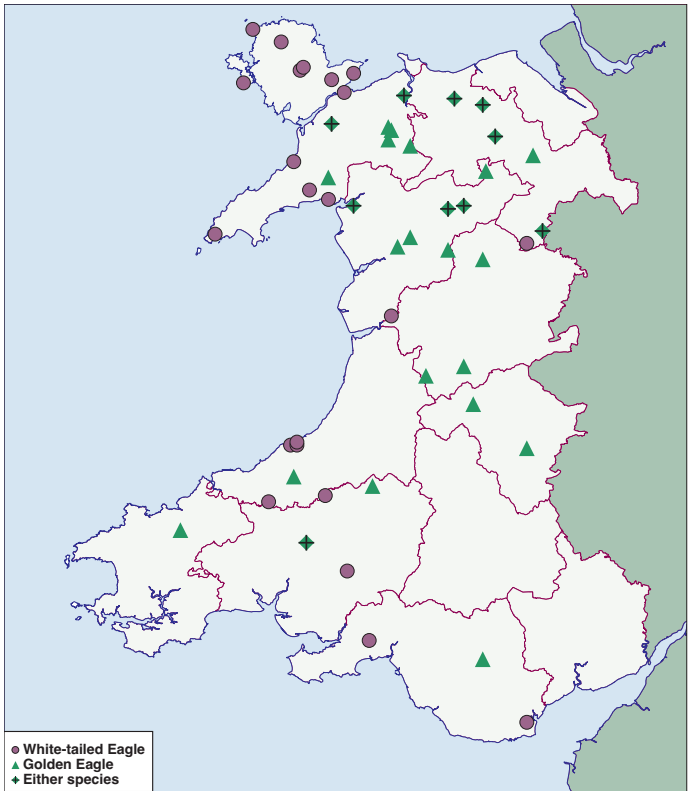

Figure 1. Map of place names in Wales containing the element "Eryr".

White-tailed Eagle *Haliaeetus albicilla* Eryr y Môr

There are more archaeological records of this species than of Golden Eagle in Wales, including records from the Devensian period at Cat's Hole, Gower, and further records from the Mesolithic era (12,000 to 6,000 years ago) at Port Eynon Point Cave (Harrison 1987a) and Little Hoyle cave, Pembrokeshire (Eastham 2016). Interestingly, remains have also been found at two Roman military sites, at Caerleon, Gwent (O'Connor 1986) and at Segontium, Caernarfonshire (O'Connor 1993). Some references in poetry to eagles may be to this species. The cycle Canu Heledd, dating to around 800-900 (Rowland 1990), describes eagles waiting to feast on the bodies of the fallen after a battle. The location, on the eastern borders of Powys, as well as the description of the birds, suggests this species rather than the Golden Eagle (Raye 2014). The evidence from place names (Fig. 1) suggests that this species may have been at least as common as the Golden Eagle in Wales at one time. The White-tailed Eagle has a preference for nesting in trees, unlike the Golden Eagle, which prefers crags, thus place names such as Coed yr Eryr (Eagle's Wood) are probably an indication of the presence of White-tailed Eagle.

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It should be noted that the name Eryr y Môr could sometimes be used for the Osprey (*Pandion haliaetus*) (Evans 2014), but Eryr in lowland place names is much more likely to refer to the White-tailed Eagle than to this species. Yalden and Albarella (2009) knew of no records of archaeological remains of Osprey being found in Wales.

Hobby *Falco subbuteo* Hebog yr Ehedydd
Remains of this species dating from the Ipswichian period, about 125,000 years ago, were found at Bacon Hole, Gower (Harrison 1987b). This is one of only three records of remains of Hobby at archaeological sites in Britain (Yalden and Albarella 2009). There is also a reference to the species in a 14th century poem by Dafydd ap Gwilym, though no location is given (Williams 2014). Evidently the species was not unknown in Wales, though probably not a common bird.

Nightingale *Luscinia megarhynchos* Eos
The Nightingale is no longer a regular breeding species in Wales. There was a small breeding population in south-east Wales during much of the 20th century, but regular breeding had apparently ceased by the 1980s (Lovegrove *et al.* 1994). Hywel ab Owain Gwynedd (died 1170) has a poem Gorhoffedd Hywel ab Owain Gwynedd in which he praises the beauties of his father's realm of Gwynedd, and includes among these a Nightingale singing "at the confluence of the rivers". This

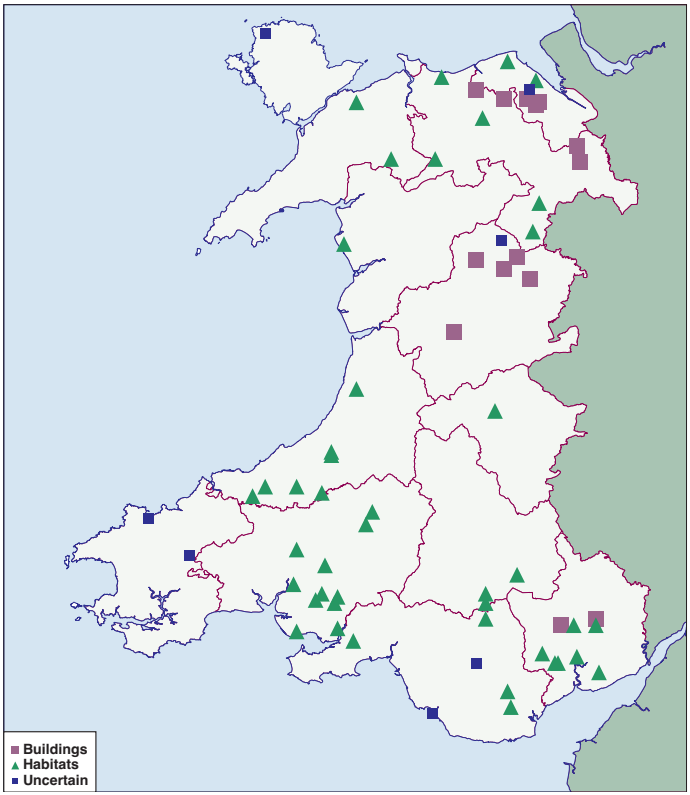

Figure 2. Map showing the distribution of place names containing "Eos" in Wales.

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may have been poetic licence, but a reference in the poem to its habitat could indicate some familiarity with the bird (Williams 2014). On the other hand a few years later Giraldus Cambrensis recorded an exchange during his journey through Wales with the Archbishop of Canterbury in 1188, which implies that the Nightingale was not found in Wales. When the travellers stopped to rest after having to dismount and struggle up some steep hills near Bangor, one of the party said that the Nightingale did not visit Wales. The archbishop smiled and commended the wisdom of the bird. Later Welsh poetry includes numerous references to the species, but many of these may not have a direct connection to the bird. Gifted poets, musicians or singers were often given the sobriquet "Eos", and many references in poetry are of this type. On the other hand, some references by poets such as Dafydd ap Gwilym (*c*.1315-*c*.1360) are clearly to the bird, which is described singing in suitable habitat. Dafydd was a native of Ceredigion, but spent considerable time in south-east Wales.

A total of 71 place names containing the element Eos were identified in Wales, excluding names thought likely to be of modern origin. These place names fall into two categories. Names of buildings could well refer to the former home of a poet or musician rather than directly to the bird. Figure 2 shows that most, though not all, place names in northern Wales are of this kind. Place names where Eos was applied to possible Nightingale habitat, such as groves, were mainly found in southern Wales (Brown 2008), and perhaps the species was always restricted to this area as a breeding bird. It may be significant that while Lewis (2006) recorded a considerable number of Welsh names for commoner species, for example 25 different names for Meadow Pipit (*Anthus pratensis*), Eos was the only name he found for the Nightingale.

Other species

Finds at archaeological sites also give the first indications of the presence of several of the more iconic Welsh species of the present day, such as Red Kite from Ipswichian interglacial deposits (c.125,000 years ago) at Bacon Hole, Gower, and Chough (*Pyrrhocorax pyrrhocorax*) at Late Glacial sites at Goats' Hole (Paviland) and Cat's Hole, Gower. The latter species may well have been nesting inside the caves.

Some species, for example the Ptarmigan (*Lagopus muta*) and the Snowy Owl (*Bubo scandiacus*), have not been recorded at Welsh sites, but have been recorded at sites not far away (Harrison 1987b), and may well have bred in Wales during colder periods. Eagle Owl (*Bubo bubo*) has also been recorded at several sites not far from Wales, and Pine Grosbeak (*Pinicola enucleator*) remains were found at Merlin's Cave, in the Wye valley but just over the border in England. Dalmatian Pelican (*Pelecanus crispus*) has been recorded as close as Somerset (Yalden and Albarella 2009), and could possibly have bred on the Gwent Levels.

Conclusion

Combining information from archaeological finds, poetry and place names can provide a good deal of information on the bird life of Wales in the period before there was any formal recording of birds. A number of species which do not now breed in Wales were clearly once part of the Welsh avifauna, but uncertainty remains about several others. There is considerable scope for further research.

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The Ring-necked Parakeet (*Psittacula krameri*) in Wales: a preliminary review of records from 1975 to 2017

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Crynodeb

Mae'r Paracît Torchog yn rhywogaeth ymledol gyda dosraniad eang, a cheir poblogaethau wedi mynd yn wyllt ar draws y byd. Mae'r boblogaeth ym Mhrydain yn ymledu, gyda nifer gynyddol o gofnodion yng Nghymru. Roedd 511 cofnod o'r rhywogaeth yng Nghymru rhwng 1974 a 2017 yn ôl y Rhwydwaith Bioamrywiaeth Cenedlaethol (NBN). Mae cysylltiad rhwng dosraniad y cofnodion ac ardaloedd trefol, yn enwedig yn ne-ddwyrain a gogledd-ddwyrain Cymru. Tra nad oes tystiolaeth o nythu ar hyn o bryd, mae'r cofnodion yn awgrymu'n gryf fod poblogaethau wedi eu sefydlu. Archwiliwyd Adroddiad Adar Cymru rhwng 1995 a 2018 er mwyn darganfod maint heidiau; er bod heidiau o hyd at 6, roedd 83% o gofnodion yn adar sengl. Nid yw dosbarthiad cofnodion hanesyddol a diweddar yn awgrymu eu bod ar hyn o bryd yn cael effaith ar rywogaethau adar brodorol sy'n nythu mewn tyllau, er y gallai fod effaith ar raddfa leol ar y rhain a defnyddwyr tyllau eraill. Gall fod y dosraniad presennol yn awgrymu problemau yn y dyfodol i dyfwyr ffrwythau yng Nghymru, a hefyd aflonyddiad twrw. Awgrymwn gadw llygad mwy gofalus ar y rhywogaeth yma, a'i chofnodi yn fwy manwl yng Nghymru.

Summary

The Ring-necked Parakeet is a widespread and invasive species with feral populations across the world. The feral population in Britain is expanding its distribution, with increasing numbers of sightings in Wales. There were 511 recorded sightings of the species in Wales between 1974 and 2017 collated by the National Biodiversity Network (NBN). The distribution of sightings is correlated with urban areas, especially in the southeast and northeast of Wales. While there is no evidence of contemporary breeding, these findings strongly suggest population establishment. We examined Welsh Bird Reports spanning 1995-2018 to explore flock size; although the maximum flock size was 6, 83% of records related to single birds. The current distribution of historical and more contemporary records does not indicate current impacts on native cavity nesting bird species, although this does not exclude localised impacts on these or other cavity users. However, the current distribution may point to issues ahead for fruit growers in Wales, as well as noise disturbance. We recommend increased vigilance and more detailed recording of all sightings of this species in Wales.

Introduction

The Ring-necked Parakeet (also known as Rose-ringed Parakeet) *Psittacula krameri*, hereafter 'parakeet', is a large green parrot from Asia and Africa (Forshaw 1989), but it is now a common British bird. The striking appearance of the parakeet has made it a popular cage and aviary bird

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across the world. This popularity has led to the establishment of feral populations in at least 35 countries, through accidental (i.e. escapees) or intentional releases (Butler 2003, Heald *et al*. 2019). There are mixed feelings about the presence of this exotic species across the UK, varying from a colourful addition to the garden bird community to an aggressive invasive species (Menchetti and Mori 2014).

Parakeets are hard to miss, owing to their bright green plumage, loud squawking call, and their close association with urban and suburban habitats ('synanthropy'), making them easy to identify, report and track by members of the public. Parakeets were first recorded in Britain in Norfolk in 1855, but only established viable wild populations in the 1960s in the southeast of England in Kent (Heald *et al*. 2019). Larger populations appeared around London and Greater Manchester in the 1970s (Butler 2005). By the late 1990s there were at least 1,500 birds in Greater London (Pithon and Dytham 1999) and since then there have been increasing reports of expansion into the Midlands and the North of England (Butler *et al*. 2004, Ogilvie *et a*l. 2004, Balmer *et al*. 2013). Our understanding of the spread of parakeets was greatly improved by their inclusion in the Breeding Bird Survey (BBS) from 2004, when they were recorded in 76 squares (3%; Raven *et al*. 2005). The most recent estimate for the British population is at least 12,000 pairs (Woodward *et al*. 2020). The parakeet population is considered to be increasing at a rate of 30% per year, with increasing numbers of sightings in non-urban areas (Butler 2003). The expansion of this species has led to concerns regarding its potential to impact native species, particularly other cavity nesting species including birds (Strubbe and Matthysen 2009; Newson *et al*. 2011), mammals such as Red Squirrels (*Sciurus vulgaris*), mice and bats (Hernandez-Brita *et al*. 2018) and invertebrates, such as the honey bees (*Apis* spp.) (Menchetti and Mori 2014). There are also concerns about their negative impact on agriculture, orchards and noise pollution (Manchetti *et al*. 2016).

The species has attempted to breed in Wales, with a pair nesting in Denbighshire (Vice County 50) in 1979, but the male bird was shot in 1980 (Lovegrove *et al.* 1994). The species is not yet considered to be established in the country (Hughes 2020). To date, there has been no systematic review of Ring-necked Parakeet records in Wales, despite Wales being being home to, and important for, a number of cavity nesting species that are red-listed as Birds of Conservation Concern at the levels of both the UK (Eaton *et al.* 2015) and Wales (Johnstone and Bladwell 2016), and having a growing horticultural sector (Welsh Government 2015). In this study, we present a review of records of Ring-necked Parakeets in Wales from 1974 to 2017, downloaded from the National Biodiversity Network (NBN). We summarise the distribution, order of sighting, flock size and habitat associations to identify any trends in their spread in Wales.

Methods

Data Sources

We obtained records of Ring-necked parakeets, collated by the NBN Atlas (https://nbnatlas.org/about-nbn-atlas/), from 1974 to 2017. While other large, green parakeets are kept in the UK, the Ring-necked Parakeet is by far the most common, and we therefore included all "unconfirmed" records in our review. As too few of the NBN records (1.8%) contained counts of individuals, we reviewed issues of the Welsh Bird Report (Welsh Ornithological Society) from 1995 to 2018, for more detailed records in order to provide a measure of flock size and formation in Wales.

These data were used to determine the presence of parakeets in 10-km squares, summarised by date first recorded, flock size and seasonal occurrence. Records with six or eight figure grid reference

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locations (n = 255) are summarised according to habitat type as classified by the Land Cover Map (LCM) 2015 released by the Centre for Ecology and Hydrology (CEH 2015). The LCM layer comprises habitat boundaries of broad habitat types which have been derived from satellite data (from Landsat-8) at a resolution of 25m. The LCM distinguishes two 'built-up' habitat categories: 'urban', defined as dense areas usually devoid of vegetation (such as town and city centres, industrial areas and car parks) and 'suburban', which includes less dense residential areas often with gardens and trees. As such these two layers encompass villages, towns and cities. All data analysis and production of figures was undertaken using the GIS software ArcGIS Pro (Esri Inc. 2019) and the statistical software R (R Core Team 2019).

Results

The NBN returned 511 records attributed to Ring-necked Parakeets in Wales; 402 (78.67%) were classed as "Accepted" (223 records) or "Accepted – considered correct" (179 records), the remaining 109 records (21.33%) were considered "Unconfirmed-plausible" (37 records) or "Unconfirmed" (72). 57 records contained no date information. There were no parakeet records in the Welsh Bird Report (WBR) in the period 1995 to 2003. With the exception of 2005, the species was reported annually in the WBR in the period 2004 to 2018; the number of records per year varied annually from one (2006 and 2007) to 17 (2016).

Distribution and number of sightings

The distribution of parakeets in Wales was correlated with urban areas especially in southeast Wales (Figure 1), with 82% of a subset of 255 records with six or eight figure grid references being within 0-1km of an urban area (Figure 2). Here an urban area is defined as any area of substantial human habitation (i.e. villages, towns and cities). The highest number of records (33-82 records per 1km^2) were from the southeast, particularly Cardiff and Swansea, and from the northeast of Wales, in Mold and Ruabon. Contemporary records, from 2010 onwards, were evenly distributed within the geographical range of sightings.

Flock Size

Of the 60 records in the Welsh Bird Report, 50 related to single birds (Figure 3). The highest flock sizes of 4-6 individuals all came from a cluster of locations within an area from Rhyl and Rhuddlan eastwards along the Flintshire coast to the Dee Estuary, in two consecutive years (2016 and 2017), suggesting they related to the same birds. The highest of these counts was of 6 in 2016, with four seen twice in 2017.

Seasonal Occurrence

Ring-necked Parakeets were recorded throughout the year although there appears to be a seasonal variation (Figure 4), with the fewest records in June (5.8% of records) July (4.5%), and August (7.6%). There were two peaks in records; one in in October (11.1%) and November (10.2%), and the other in March (9.4%) and April (10.2%).

Habitat Associations

There were 255 NBN records that had precise location data. Of these records, 62% were associated with the urban/suburban environment (i.e. villages, towns and cities), 12.8% with improved grassland, 7.1% with broadleaved woodland and 6.7% with arable fields (Figure 3). The majority of records in southeast Wales are associated with urban and suburban areas, with very few records were noted in other habitats (Figure 4).

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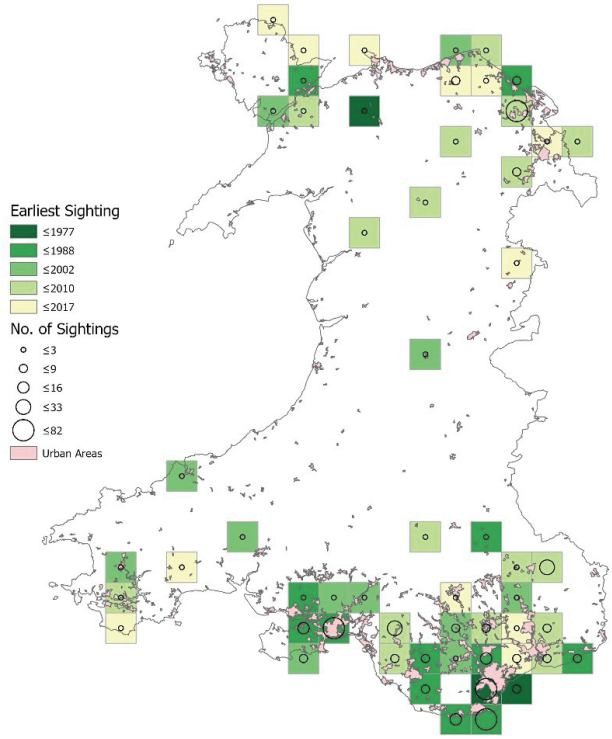

Figure 1. Distribution and age of 511 records of Ring-necked Parakeet *Psittiacula krameri* in Wales between 1974 and 2017. All records were sourced from the NBN Atlas (**https://nbnatlas.org/about-nbn-atlas/**).

Discussion

In this preliminary review, we examined 511 records of Ring-necked Parakeet recorded in Wales between 1974 and 2017 from the NBN Atlas and described their distribution, order of sighting, and habitat associations. In addition we used 60 records from the Welsh Bird Report spanning 1995 to 2018 to review flock size. NBN records showed a strong spatial correlation with urban areas, such as villages, towns and cities, particularly in the southeast. This distribution is perhaps not unexpected and consistent with other parts of its range, and is probably the result of the species being more widely kept in urban and suburban areas, and perhaps a preference for warmer micro-climates. The supplementary feeding of birds, generally, may also help "keep" this species within urban areas. It is also likely that parakeets make significant use of non-urban habitats but that fewer records of these associations are made due to the lower density of observers in those habitats. We found no

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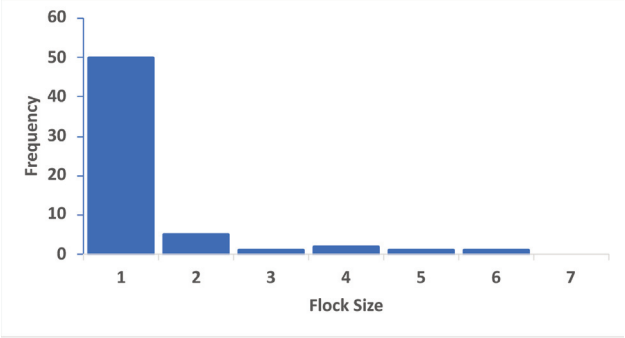

Figure 2a. Flock size, (b) distance to nearest urban area and (c) monthly distribution of Ring-necked Parakeet records.

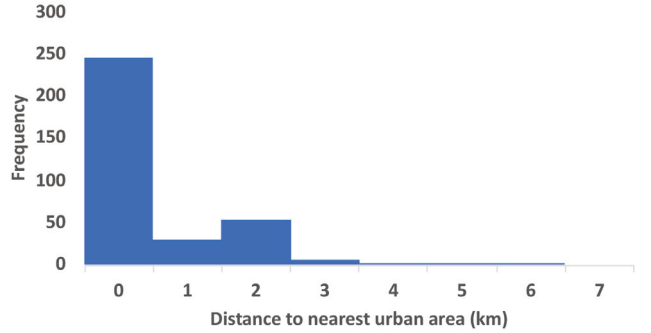

Figure 2b.

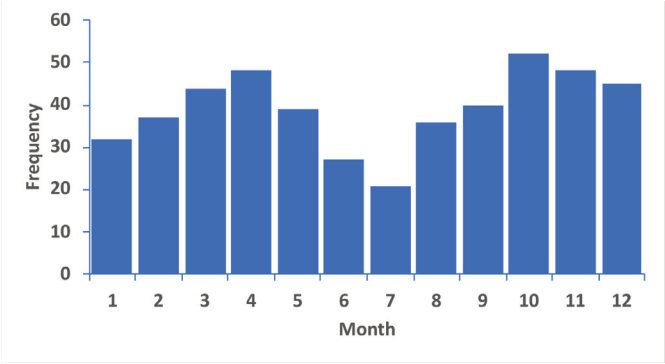

Figure 2c.

evidence of regular breeding within the NBN or Welsh Bird Report data (but see Lovegrove *et al.* 1994 for historical context). Given the species' conspicuous presence when breeding it seems unlikely that attempts would have not been detected, especially in villages, towns and cities where there are more observers.

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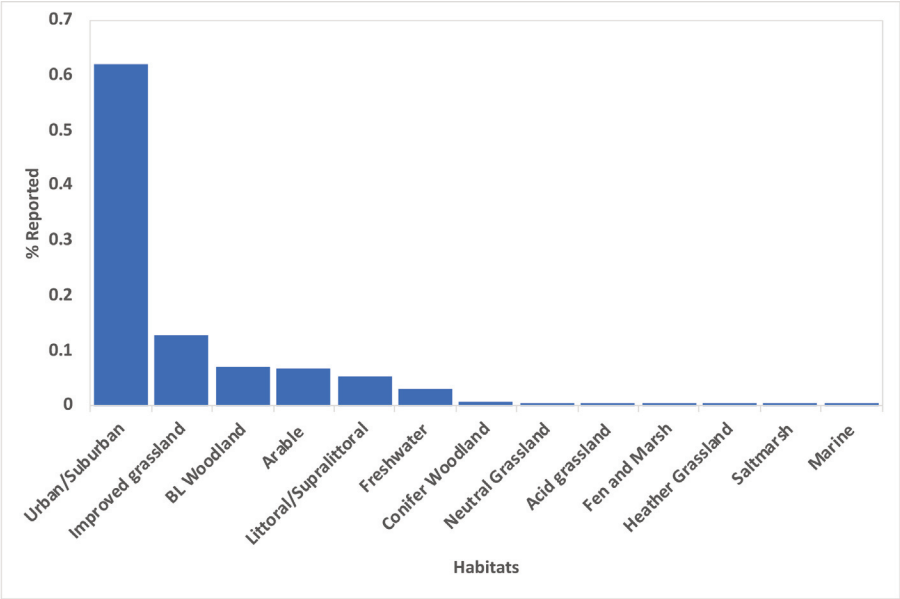

Figure 3. Habitat associations of parakeet records with accurate locations from the NBN Atlas (1974-2017, **https://nbnatlas.org/about-nbn-atlas/**).

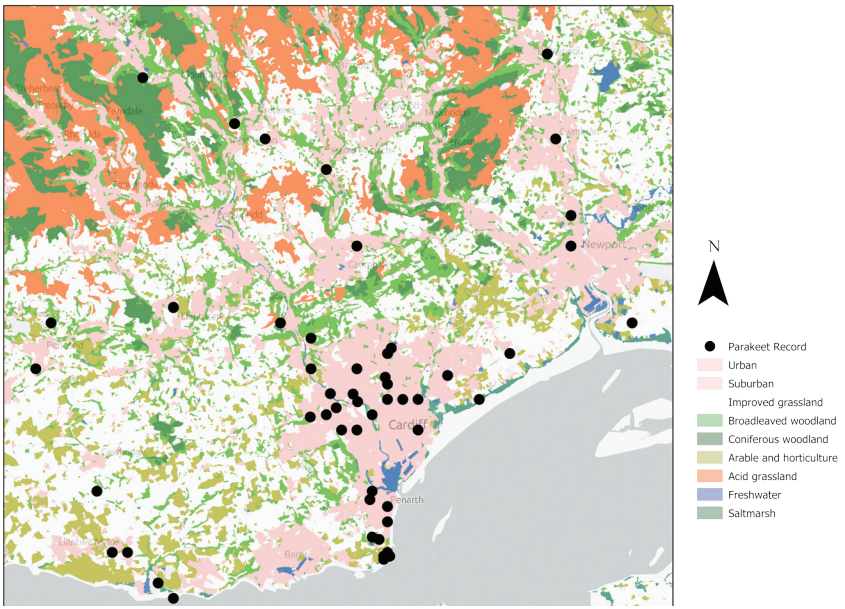

Figure 4. Habitat associations of Ring-necked Parakeet records in southeast Wales from the NBN Atlas (1974-2017, **https://nbnatlas.org/about-nbn-atlas/**).

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While the NBN data represent a collation of multiple sources of evidence, there are some limitations to using this aggregated source. It is not possible to assess recorder effort or number, meaning it is not possible to properly assess absolute changes in abundance. Similarly the method by which the data were obtained, for example through "casual" observation or as part of a systematic survey, is unknown. The resolution of some of the data, i.e. 10-km squares, meant we had to ignore about 50% of the available records when looking at habitat associations; the limited inclusion of count data meant we were unable to draw on these data when looking at flock size. Although schemes such as Bird Track, Local Records Centres and county bird clubs/ornithological societies contribute data to the NBN, there are likely to be data that are missing. As a result we limited our interpretation to a descriptive over view. Despite these limitations, NBN data have been used in studies exploring the distribution of Ring-necked Parakeets specifically (e.g. Heald *et al*. 2019), and more generally in studies concerned with species distribution (e.g Beebee and Ratcliffe 2018, Jewak *et al*. 2018, Manzoor *et al.* 2018).

Currently the Ring-necked Parakeet is considered "not yet established in Wales" with sightings attributable to local escapees rather than colonisation or movement from existing, established populations (Hughes 2020). We found no evidence of recent, regular breeding, which supports the view that the species is yet to have established a breeding population in Wales. However, in a feral state in the UK this a long-lived species (Robinson 2015), with populations derived from multiple releases and escapees building a feral breeding population over time (Heald *et al*. 2019). While there is no evidence that the Ring-necked Parakeet population in Wales is yet self-sustaining, there is some evidence that the number of sightings per year is increasing, particularly in the southeast (Wilson 2019, Hughes 2020). This may point towards a species that is in the early stages of establishment, through multiple releases. However the apparent lack of sustained regular sightings of multiple birds may counter the premise that the species is establishing itself. While the only historical breeding record for the species was in North Wales (Lovegrove *et al*. 1994), regular breeding, if and when it does occur, is likely to be in the urban areas of the southeast where the number of recent records appears highest. It is not possible to suggest time scales. based on the current evidence, as to when this might occur.

The review shows that, while records are spread throughout Wales, the majority and the most recent are in the southeast and northeast of Wales, associated with areas of human habitation, and away from areas or landscapes containing important populations of cavity nesting species of conservation concern. This localised and mainly, urbanised distribution, combined with the relatively low number of individuals, and the lack of recent evidence for breeding, suggest that the Ring-necked Parakeet is unlikely to be having a major impact on cavity nesting birds at present. Indeed the evidence of impact of this species on other cavity nesting species is unclear; Strubble and Matthysen (2007) found the presence of Ring-necked Parakeet only had a negative effect on Nuthatch (*Sitta europea*), while Newton *et al*. (2011), found no evidence of a negative effect on this species, or any other cavity-nesting species, within the established breeding range of the Ring-necked Parakeet in the UK. Similarly, Czajka *et a*l. (2011) found no impact of Ring-necked Parakeet on breeding Starling (*Sturnus vulgaris*); in fact, the species showed resource portioning in relation to breeding habitat. However, this does not rule out the possibility of site-specific impacts, through competitive exclusion, on native cavity-nesting species, especially where suitable cavities are limited (Newton *et al*. 2011). Given the apparent low density of the species in Wales these local impacts are likely to be small.

The Ring-necked Parakeet is considered a major pest on fruit crops in its native range (Ali and Ripley 1969). The current distribution of Ring-necked Parakeet and its possible future expansion in southeast Wales may therefore be of concern to the Welsh horticultural sector. Approximately 63%

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of the 77 fruit and vegetable growers in Wales registered with the Horticulture Development Council (i.e. those with an annual turnover of >£25,000) in 2007 were based in the southeast (26%) and southwest (37%) of Wales (Frost *et al*. 2007). Between 2010 and 2015 the area of orchards and small fruit production across Wales increased by 16% (Welsh Government 2015), and it is predicted to continue to grow. While these figures include growers across the spectrum of horticulture (excluding flowers), and do not necessarily include all smaller scale or specialist fruit growers, they do highlight the potential impact that an establishing and expanding population of Ring-necked Parakeets could have on a growing horticultural sector in Wales.

The majority of records (50 of 60) reported in the Welsh Bird Report were of sightings of single individuals, with only a handful of sightings of two or more birds (Figure 2a). The prevalence of single-bird sightings is consistent with ad hoc escapees. There are two, complementary, explanations for the multi-bird sightings. Firstly, these may be the result of multiple birds escaping, for example, from the same aviary. Secondly, and perhaps more concerning, these may represent birds from multiple origins locating each other and forming small flocks. The highest groups of 4-6 birds were reported multiple times in a relatively small geographic area (in Flintshire) over two years. The flock initially contained 6 birds but had reduced to four by the following year, with none reported the year after that. The reduction, and apparently extinction, of this flock may be the result of predation, dispersal, recapture, or intentional eradication, or a combination of these. Alternatively the apparent disappearance may be the result of non-reporting. This highlights a constraint of reviews of this nature – it is not possible to control for variation in observer effort or account for unrecorded birds. However, the multi-bird sightings do show that groups of this species do occur in Wales, even if group size is small and persistence short-lived.

There were two seasonal peaks evident in the data, when all years were considered. The first, in March and April, coincides with the early part of the breeding season for this species in the UK (Butler *et al*. 2013). While there was no evidence of breeding from the records reviewed here, this "breeding season" peak may be the result of male parakeets being more vocal in an attempt to attract a partner and hence being more obvious to observers. The peak in late autumn/early winter may be the result of two, not mutually exclusive, factors resulting in more records at this time. Firstly, this may reflect a greater attraction to garden bird feeders during more inclement weather. Many of the records from this time of year, reported in the Welsh Bird Report, were of birds on feeders. Secondly, this may represent a period of greater rates of escape. Higher winds or storms, expected at this time of year, may result in greater damage to aviaries, or shorter days combined with inclement weather may lead to a greater rate of human error. Heald *et al*. (2019) found that records of Ring-necked Parakeets in London increased ten-fold the year after the "great storm" in 1987. In addition, more birds would be present in the captive population, after the breeding season, which would swell the ranks of potential escapees.

Conclusions

While we found no evidence that the Ring-necked Parakeet has established itself as a breeding bird in Wales, we suggest that the species is establishing a feral population in Wales that is currently maintained by escapees. As a result, it is recommended that all observations of free-flying Ring-necked Parakeets are considered important and reported. In addition to site, which should be as accurate as possible, and date, the recording of the time of the observation, and direction of travel where appropriate would greatly enhance the value of such records by allowing more confidence as to whether sightings from the same general geographic area relate to the same or different individuals. We also recommend that sightings of individuals in suitable breeding habitat during the breeding season are followed up in order to ascertain potential pair establishment or actual breeding.

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Starlings at Newport Wetlands (John Marsh)

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Newport Wetlands National Nature Reserve: a review of the first 20 years

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Crynodeb

Mae Gwlyptir Casnewydd wedi datblygu o fod yn warchodfa natur newydd i fod yn SoDdGA sydd a 19 rhywogaeth wedi eu dynodi, 13 o'r rhain yn unig oherwydd creu a rheoli'r warchodfa. Llwyddodd Gwlyptir Casnewydd i gyrraedd ei nod o ddenu dwy rywogaeth o adar dŵr mewn niferoedd o bwysigrwydd cenedlaethol ac o ddod yn “rhan weithredol o Ardal Warchodaeth Arbennig Môr Hafren” fel y gorchymynnwyd gan yr Ysgrifennydd Gwladol yn 1996 (Austin *et al*. 2006). Mae'r gwelyau cyrs a grëwyd yn cynnal pum rhywogaeth mewn niferoedd o bwysigrwydd cenedlaethol. Dynodwyd y lagwnau heli ar gyfer tair rhywogaeth o adar rhydyddol sy'n nythu yno. Mae cynefin ffosydd cae Gwlyptir Casnewydd yn cynnal cyfartaledd lawer uwch o blanhigion dŵr hysbysadwy nag unrhyw SoDdGA arall ar Lefelau Gwent. Mae'r morfa heli o fewn ffiniau'r Warchodfa Natur Genedlaethol yn awr yn fwy amrywiol nag yr oedd ugain mlynedd yn ôl. Ymhlith y tasgau i'r dyfodol mae gwella cynhyrchiant y rhywogaethau o adar rhydyddol.

Summary

Newport Wetlands has matured from a created nature reserve to a designated SSSI, notified for nineteen species, thirteen of which were entirely down to the reserve’s creation and management. Newport Wetlands has achieved it’s aim of attracting two species of waterfowl in nationally important numbers and becoming a "functional component of the Severn Estuary SPA" as required by the Secretary of State in 1996 (Austin *et al*. 2006). The created reedbed supports five species in nationally significant numbers. The saline lagoons have been notified for three breeding wader species. The Newport Wetlands field ditch habitat has a much higher proportion of notifiable aquatic plants than any other Gwent Levels SSSI. Saltmarsh habitat within the NNR boundary is now more diverse than it was twenty years ago. Future challenges include reversing the poor productivity of wader species.

Introduction

Newport Wetlands National Nature reserve (NNR) straddles the Severn Estuary SAC, SPA and RAMSAR site and a suite of Gwent Levels SSSIs, which have now been amalgamated into the Newport Wetlands SSSI. The NNR is comprised of 865.72 hectares of mudflats, saltmarsh, ditches, saline lagoons, flooded grassland, reedbeds, standing water and extensively managed pastoral farmland.

The reserve's flooded grasslands, saline lagoons and Severn Estuary habitats are important for large numbers of wintering water birds particularly Black-tailed Godwit *Limosa limosa* and Shoveler *Anas clypeata*. These habitats also support several species of breeding wader most notably, Avocet

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Recurvirostra avosetta, Lapwing *Vanellus vanellus* and Redshank *Tringa totanus*. Important Severn Estuary features on the reserve include Atlantic salt meadows, intertidal mudflats and sandflats and an intertidal *Sabellaria* reef. Only the salt meadows are actively managed. The ditches that criss-cross the grasslands are important for their plant and invertebrate communities including rare plants such as Hair-like Pondweed *Potamogeton trichoides* and Rootless Duckweed *Wolffia arrhiza* and the rare invertebrates including Great Silver Water Beetle *Hydophilus piceus*, the water beetle *Hydaticus transversalis* and the Ornate Brigadier Soldierfly *Odontomyia ornata*. The 44.1 hectare reedbed is notifiable in its own right. It supports nationally significant populations of Bearded Tit *Panurus biarmicus*, Cetti's Warbler *Cettia cetti*, Water Rail *Rallus aquaticus* and the water spider *Tetragnatha striata*. The flower rich paths that run through the reedbed support one of Britain's most important populations of Shrill Carder Bee *Bombus sylvarum*. Other significant wildlife includes Great Crested Newts *Triturus cristatus*, (so far only discovered twice), Otters *Lutra lutra*, Brown Hare *Lepus europaeus*, Water vole *Arvicola terrestris* and two pairs of breeding Barn Owl *Tyto alba*. Two terrestrial plant species on the IUCN GB Red List include *Chenopodium glaucum* and *Monotropa hypopitys.*

Since the arrival of the RSPB Visitor Centre, the number of visits has grown to a peak of around 118,000. Depending on the year RSPB can engage over 5000 school children in environmental education.

Newport Wetlands is significant for its archaeological features dating back to Mesolithic times. Mesolithic human footprints and a submerged forest at the far south east of the reserve are particularly important.

History/background

The Newport Wetlands NNR represents part of the compensation measures for the loss of the Taff/Ely Estuary Site of Special Scientific Interest (SSSI) to the Cardiff Bay Barrage Project. The Reserve is a wetland creation project, originally designed to provide habitat for wetland bird species. Full planning permission consent for the development of saline lagoons, reedbeds and lowland wet grassland was granted in November 1997, subject to 29 conditions. The Reserve was acquired by the Land Authority Wales in February 1998 and habitat creation works were undertaken by Cardiff Bay Development Corporation. Ownership of the Reserve passed to CCW in March 2000. In October 2006 the British Trust for Ornithology assessed the reserve data (Austin *et al*. 2006) and concluded that the reserve had achieved the Reserve Steering Group target of attracting two species of waterbird in nationally important numbers over a five year average, and had become a "functional component of the Severn Estuary SPA" and therefore suitable for qualifying as part of the Severn Estuary SPA which was the goal set by the Secretary of State in 1996. Newport Wetlands was managed by a succession of three RSPB staff on secondment to CCW, Mark Underhill, Adam Rowlands and Tony Pickup. It was there management that lead to the reserve reaching its targets in 2006.

Newport Wetlands was declared a National Nature Reserve in April 2008. In March 2010 Newport Wetlands was declared a SSSI in its own right, with 19 notified features, 14 of which are due entirely due to the reserve's creation in 2000. In 2003 CCW, RSPB and Newport City Council signed a "Statement of Intent" in respect to providing environmental education. In March 2008 an environmental education and visitor centre run by the RSPB was opened. The visitor centre and car park were leased to the RSPB on a 75 year peppercorn rent.

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Reedbeds and associated species: creation, management and change

To the West of the NNR, inland of the sea wall, there is an area of approximately 120 hectares. In the 1970's and 80's the land was used for depositing pulverised fuel ash (PFA) from the nearby Uskmouth Power Station. By 1995 approximately half this area had been filled with PFA to a depth of approximately 4.5 metres, capped, sown with agricultural grasses and was being grazed, mainly by sheep. The non-grazed areas were of local conservation interest, being typical of un-reclaimed PFA sites, including two large colonies of orchids, predominantly Common Spotted *Dactylorhiza fuchsii* and Southern Marsh *D. praetermissa*. Marsh Helleborine *Epipactis palustris* and Bee Orchid *Ophrys apifera* were also found (The Environment Practice 1995). There was, and remains, a reed-edged pool to the west of where the Visitor Centre is today. The two reedbeds to the far east of the reedbed area, now called RB10 and RB11, were present throughout the nineties. The wetter northerly reed bed (RB11) has a bund covered largely on its outer face by Hawthorn *Crataegus monogyna*. The Goldcliff Ringing Group have been catching, ringing and recording their findings on this bund since 1994.

Six reedbeds of fairly uniform topography were excavated in the PFA in 1998. Each reedbed has a channel on one side; they are approximately 1.2 to 1.5 metres deep and between 25 and 45 metres wide. Each reedbed is connected to two others via a culvert. The reedbed was planted with one-metre square reed turves approximately three metres apart. It took only about a year for the reed to become established. The wet reedbed covers 43 hectares.

In 2010 Newport Wetlands SSSI was notified. The Citation mentioned nationally important breeding populations of Water Rail, Cetti's Warbler and Bearded Tit. The reedbeds were also cited as "the largest within the south-east Wales area. In wetter areas with standing water, the vegetation is almost entirely composed of Common Reed *Phragmites australis*. However, in drier areas, it is joined by Marsh Bedstraw *Galium palustre*, Hemp Agrimony *Eupatorium cannabinum* and Great Willowherb *Epilobium hirsutum*."

The nationally scarce Shrill Carder Bee is also mentioned in the SSSI citation. The vast majority of sightings are around the reedbed paths, which are festooned with Narrow-leaved Everlasting Pea *Lathyrus sylvestris*, Meadow Vetchling *Lathyrus pratensis* and Tufted Vetch *Vicia cracca*. The reedbed also supports a nationally important population of the spider *Tetragnatha striata*.

Management

Water is held at maximum level from January to March, with a lower limit of 20cm above litter level. From April to the end of July the lower limit is set at 10cm above litter level, and water is drawn down at this time to supplement water levels on the grasslands. From August through December the lower level is set at 5cm above the litter level, except where draw down might be necessary for agricultural equipment to cut and bale reed. In reality the water level is at its lowest in late summer and gradually builds with rainfall into winter.

Due to the topography, the reedbeds are very uniform and the reed to open water interface is only along the side of the deep channel. For this reason, an amphibious cutting machine has been used in winter to create open water in the reeds, to provide more edge habitat and in recent years to maintain the open water channels. The edge habitat benefits the spider *Tetragantha striat*a and improves hunting opportunities for Bittern *Botaurus stellaris*.

To prevent build-up of thatch and succession to a drier habitat, approximately 2ha of reed are

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planned to be cut and removed every year in rotation. In practice, in some years this is not possible, but approximately 20ha will have been cut in 20 years. Scrub, predominantly willow *Salix* species, is cut most years in the drier parts of the reedbed to prevent succession. The reedbed path edges are cut and baled annually in October to maintain the flower rich verges for Shrill Carder Bee.

Reedbed bird species

From 1994 to 1999 up to three singing male Cetti's Warblers were recorded during the breeding season at Uskmouth (Common Bird Census data). In 2008 numbers had risen to 72 territories and Cetti's Warbler became a SSSI feature of the reserve. There seems to be some correlation between the number of breeding territories and the preceding winter's mean temperature (see Figure 1). The first pair of Bearded Tit bred in 2007, and since then they have bred every year with a mean

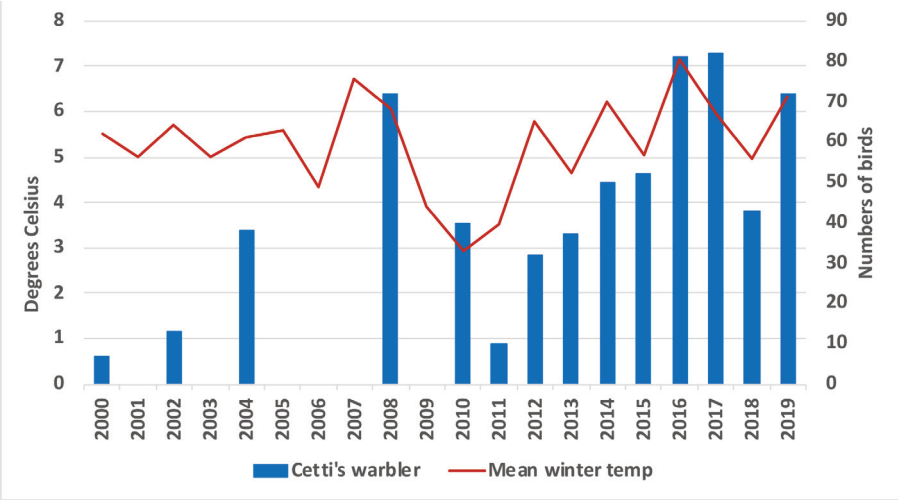

Figure 1. Cetti's warbler breeding pairs v. mean winter temperatures.

average for all the years of 4.17 pairs per year. From 1996 to 1999 up to 3 pairs of Water Rail were discovered using a tape lure method described by Clarke (2006). Numbers peaked in 2005 with 24 pairs (Clarke 2006). The mean average from 2000 to 2019 is 6.77 pairs per year. Marsh Harrier (Circus aeruginosus) nested in 2016, but failed to raise any chicks. In 2017 they successfully fledged one chick, then two in 2018 and three in 2019. Bittern nested in 2018 and 2019, although there has been no evidence of chicks fledging. In 2020 2-3 Bitterns fledged from two separate nests.

Wet grasslands and ditch network

The wet grasslands were created over the Triasssic Mercia mudstone bedrock, which is overlain by Quaternary estuarine alluvial deposits consisting of silty clays, typically 10-13m thick and containing peat and submerged forest beds. General ground conditions on the Reserve are groundwater gley soil, developed within, or over, permeable materials that have prominently mottled, or uniform grey subsoils resulting from periodic waterlogging by a fluctuating groundwater table. During the winter, flooding swells the clays whilst, in dry summers, extensive cracking/dessication can occur which can extend into the soil profile.

The wet grasslands consist primarily of eleven bunded field blocks, seven of which form a large

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uninterrupted block. The land was formerly a mixture of arable and pasture land. The pasture land was largely agriculturally improved, NVC communities MG6a, MG7a, MG7b and MG7d and therefore of limited conservation value (The Environment Practice 1998). However small numbers of Brown Hare were regularly seen. The grassland also supported breeding grassland birds including Grey Partridge *Perdix perdix* and Tree Sparrow *Passer montanus*, last recorded on the Common Bird Census in 1997 and 1988 respectively.

The old pasture land had retained its characteristic field grips, providing topographical variation and variation of flooded grassland at different water levels. The arable fields were gripped in 2003 using the RSPB's Liebrecht Rotary Ditcher. A bund was created around each field block by digging down through the soil to the clay and compacting clay on top to a height of approximately 600mm above ground level. The water level in each field block is controlled by a drop board sluice. Ten pond-like features were created within the bunded areas by cutting a parallel ditch alongside a section of ancient ditch.

The network of SSSI ditches pre-dates the reserve; some of the original land reclamation was carried out in Roman times. A new ditch approximately 2.5km long was dug to transport water from the reedbeds through the wet grasslands. This ditch was v-shaped and much shallower than the traditional Gwent Levels ditches. 226 metres of previously filled in ditch was restored in 2008. Some ditch habitat was lost with the creation of the Saline Lagoons.

Management

The grasslands reach peak flooding by December, and at this stage approximately 60% of the central wet grassland blocks will be flooded. Holding the water level this high in winter requires all the feeding ditches to be brim-full. This is the opposite to the traditional management of the Levels, where water is let off in the winter and then held up once the threat of flood has passed. Water levels are brought down on the reserve at the end of February or the beginning of March to about 40%, with the aim of providing areas of bare ground for nesting Lapwing. Water levels gradually fall by evapotranspiration, with the lowest levels in August. The aim is to keep water in the grips throughout May for fields with breeding Lapwing. Water levels are reduced to below field level in areas with no breeding waders to reduce the growth of Hard Rush (*Juncus inflexus*) and Soft Rush (*Juncus effusus*). In theory ditches could be prevented from drying out by drawing down water from the reedbeds. In practice the priority in a drought year is to prevent the saline lagoons from drying out.

Water is let down by gravity from the reedbeds in August, which are four metres higher than the surrounding farmland. One field block will have water pumped on from the surrounding ditches in September, creating flash flooding of about 40% and providing habitat for early migratory wildfowl. Water levels are then gradually increased to hit winter levels in December. In a normal year this is achieved by rainfall alone, but water will be pumped on from surrounding ditches in a dry year. The target for sward height is 50-65% less than 5 cm in height. This is to encourage Lapwing to nest and provide good grazing opportunities for Wigeon *Mareca penelope*. It is achieved by retarding growth through flooding and sheep grazing after the nesting season. 30-50% of the wet grasslands should be tussocky sward to encourage Skylark *Alauda arvensis* and Redshank to nest. This is achieved through cattle grazing at lower than commercial densities. Between 5% and 30% should be rush, which provides food for wildfowl in the form of seed, nesting opportunity for Reed Bunting *Emberiza schoeniclus* and shelter for wader chicks. The target for bare ground is between 5% and 15% to encourage Lapwing to breed, provide hunting and courtship areas for insects and encourage annual plants. The challenge is to keep rush cover at 30%; this is achieved by mowing all fields with more than 30% rush cover in August. The rush is baled and removed, and the re-growth topped in

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September or October.

The aim of the ditch management is to create a mosaic of seral stages. There are 25,340 metres of ditch of which 21,670 metres are managed by the reserve. The lower limit for open water which supports the two SSSI notified plants Rootless Duckweed and Hair-like Pondweed, is 5,000 metres. The mid-successional stage that benefits the SSSI notified Ornate Brigadier soldierfly and Great Silver Water Beetle has a lower limit of 5,000 metres. The late successional stage that benefits the SSSI notified water beetle *Hydaticus transversalis* has a lower limit of 5,000 metres. The choked, litter rich stage has a lower limit of 1,000 metres. The mosaic is maintained by de-weeding short sections of choked ditch with an excavator using a Bradshaw bucket. If longer sections need to be de-weeded, only one side will be done each year. Woody vegetation is flailed from ditch banks every year, particularly on the southern side. As much as 7,000 metres can be flailed each year to prevent scrub growth and shading of the ditches.

Changes in ditch flora/condition

A survey of the ditch flora of Newport Wetlands (Honour 2004) compared data from surveys using the same methodology (Winder *et al*. 1991, Honour 1993, 1997 and 2000) with data collected in 2004. The floristic diversity between the three surveys was compared using categories devised by Winder *et al*. (1991).

No. of aquatic species per 20m sample length	Category
0-10	Low diversity
11-20	Moderate diversity
21-30	High diversity

Table 1. Diversity categories in Winder *et al*. (1991).

This allows a comparative evaluation of the samples, and the extent to which they have changed over the survey period.

Sample	1997	2000	2004
R1	Low	Medium	Low
R2	Low	Low	Low
R3	Low	None	Low
R4	Medium	Low	Medium
R5	Low	Low	Low
R6	Low	Low	Low
R7	Low	Medium	Medium
R8	Low	Low	Medium
R9	Low	Low	Low
R10	Low	Low	Medium
R11	Low	Low	Low
R12	Low	Low	Low
R13	Medium	Medium	Medium
R14	Medium	Low	Low
R15	Low	Low	Low
R16	Low	Low	Medium

Table 2. Comparative evaluation of reen diversity (Honour 2004).

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Honour (2004) concludes that "There is no evidence that changes resulting from the construction of the Wetland Reserve have impacted on reen diversity. More reens are classed as 'medium' diversity in 2004 (6), compared with 3 in 1997 and 2000. While some changes may have resulted from the operation of the Wetland Reserve (e.g. higher winter water levels), others are likely to result from normal agricultural changes, and reen maintenance operations. Higher water levels, coupled with lower shading, and light stock grazing of banks are likely to combine to promote higher aquatic plant diversity."

Using rarity categories devised by Winder *et al*. (1991), Honour (2004) compares the rarity of the flora surveyed in in 1997, 2000 and 2004.

Rarity score	Category
0-10	Low
11-20	Moderate
21-30	High
31+	Very high

Table 3. Rarity categories in Winder *et al*. (1991).

This similarly allows a comparative evaluation of reen quality.

Sample	1997	2000	2004
R1	Low	High	Moderate
R2	Moderate	Low	Moderate
R3	Low	Low	Low
R4	Low	Low	High
R5	Low	Moderate	High
R6	Low	Low	Low
R7	Low	Very high	Very high
R8	Low	Low	High
R9	Moderate	Low	Low
R10	Moderate	Moderate	Moderate
R11	Low	Low	Low
R12	Low	Low	Moderate
R13	High	Moderate	Low
R14	Low	Moderate	Low
R15	Low	Low	Low
R16	Low	Low	Moderate

Table 4. Comparative evaluation of reen rarity scores (Honour 2004).

Honour (2004) concludes; "there have been some declines in rarity values, notably in the Sea Wall Reen (R13-14), but generally the recent trend is for an increase in rarity values, with the 'high' and 'very high' categories better represented in 2004 (4 sites) than in 2000 (2 sites) or 1997 (1 site)."

Between 2010 and 2013 a Gwent Levels reen and field ditch habitat survey was undertaken that included field ditches and reens within the NNR (Murton *et al*. 2017). This survey is not directly comparable with earlier surveys (Honour 1997, 2000, 2004). It does show that field ditches with higher floral diversity and rare aquatic plants are far more prevalent in Newport Wetlands SSSI than any of the other SSSIs. The survey showed that four of the five notifiable species *Potamogeton trichoides, Wolffia arrhiza, Oenanthe fistulosa* and *Hydrocharis morsus-ranae* were present on the

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SSSI. *Sagittaria sagittifolia* was not present at Newport Wetlands in the 2010 to 2013 study or the 1997, 2000 or 2004 surveys (see Figure 2).

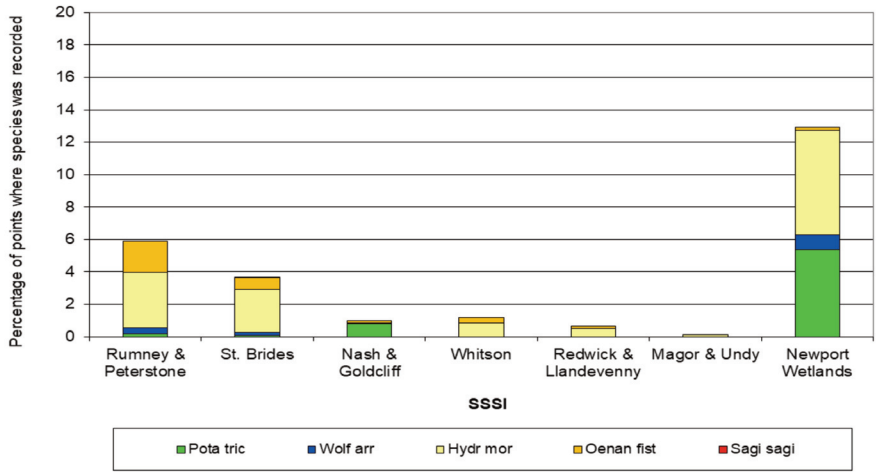

Figure 2. Bar chart showing percentage of field ditch survey points where each plant feature was found for each SSSI (Murton *et al.*2017).

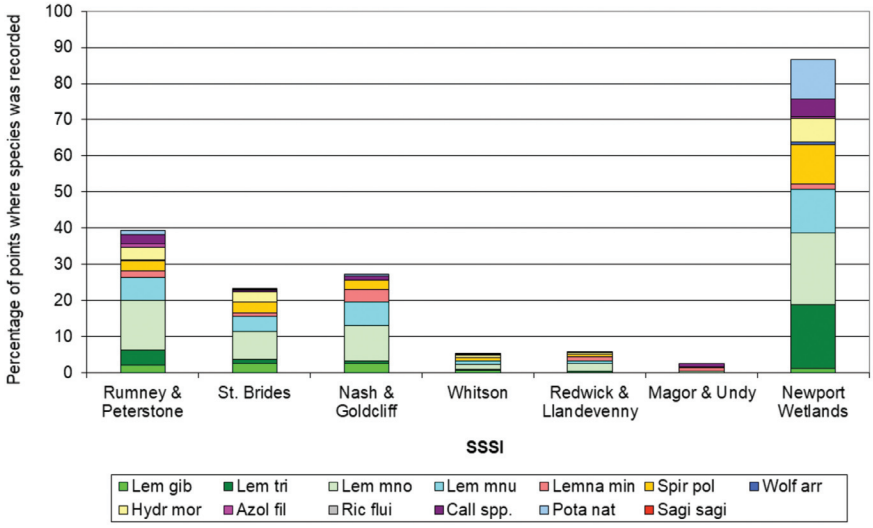

Figure 3. Bar chart showing percentage of field ditch survey points where floating plants were recorded for each SSSI (Murton *et al.* 2017).

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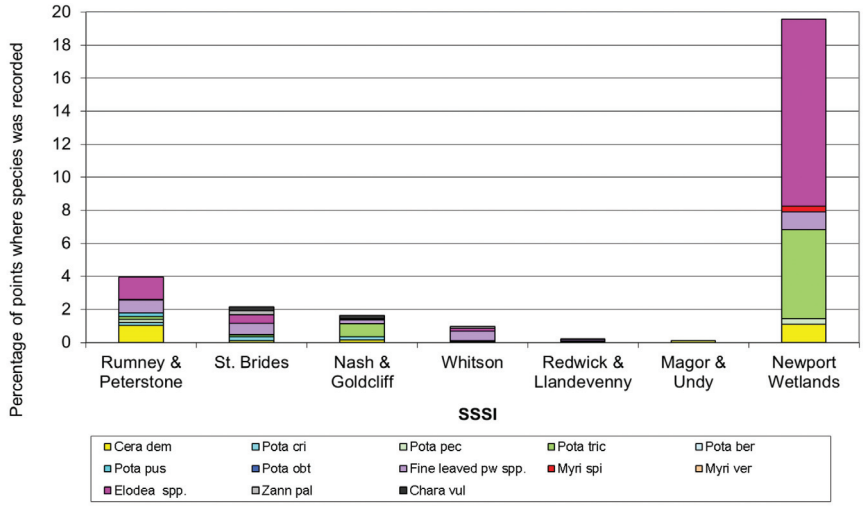

Figure 4. Bar chart showing percentage of field ditch survey points where submerged plants were recorded for each SSSI (Murton *et al.* 2017).

Wolffia was found at 19% of field ditch points, with next nearest other being 9%, see figure 3. *P. trichodes* was found at 5% of NNR ditch points but only at 1% or less on the six Gwent Levels SSSIs, see figure 4. *Hydrocharis morsus-ranae* was found at 6% of points but only at 3% or less points on the Gwent Levels SSSIs.

Surveys showed 3 of the 5 of field blocks/areas (so 60% of the SSSI areas) on Newport Wetlands were in favourable condition. For a field block/area on the SSSI to be determined as favourable over half of ditches within the block must not be overshaded by scrub or hedge. Ditches that are overshaded cannot support a submerged and floating flora and the associated special aquatic invertebrares. The next highest was 44% of field blocks on Rumney and Peterstone in favourable condition, and as low as 12.5% on Whitson.

Newport Wetlands is the only SSSI where over 5% of ditch sample points had submerged species if we exclude *Elodea* species from the samples. As *Elodea* is non-native its preferable to have other submerged flora than *Elodea*. However, Rumney and Peterstone had a higher species diversity of eight different submerged plants recorded.

Saline lagoons

The saline lagoons were created in 1999 on agriculturally improved fields identical to those used to make the wet grasslands. Three lagoons, covering a total area of 10.8 ha, were dug. In doing so some original ditches were filled in and some were incorporated in lagoon 3. The lagoons are shallow, with a gradual gradient and a maximum depth of approximately 500mm. The exception is where the old ditches ran through lagoon 3; these are approximately 1.5 metres deep. Islands were created on each lagoon. The islands on lagoons 1 and 2 have a geotextile membrane covered with imported shingle. The island on lagoon 3 is dominated by reed growth. The following species nest exclusively on lagoon 1 and 2 shingle islands: a maximum of 49 pairs of Avocet, 2 pairs of Ringed

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Comparison dates	Areas only present in older layer (ha) i.e. area of erosion	Areas only present in younger layer (ha) i.e. area of accretion	Unchanged areas of saltmarsh (ha)	Overall Change (ha)	Overall Percentage change (%)*
1988/89 & 2009	2.62	15.34	53.14	12.73	22.83
2009 & 2017	2.46	3.10	65.75	0.65	0.95
1988/89 & 2017	2.55	15.89	52.47	13.34	24.25

Table 5. Extent (ha) of saltmarsh at Goldcliff at three points in time 2017, 2009 and 1988/89. (Wilkinson *et al*. 2019.

*Different survey boundaries are used for the different between year comparisons. Therefore, the combined % change over the 1988/89 to 2017 period is not the total of the between year comparisons.

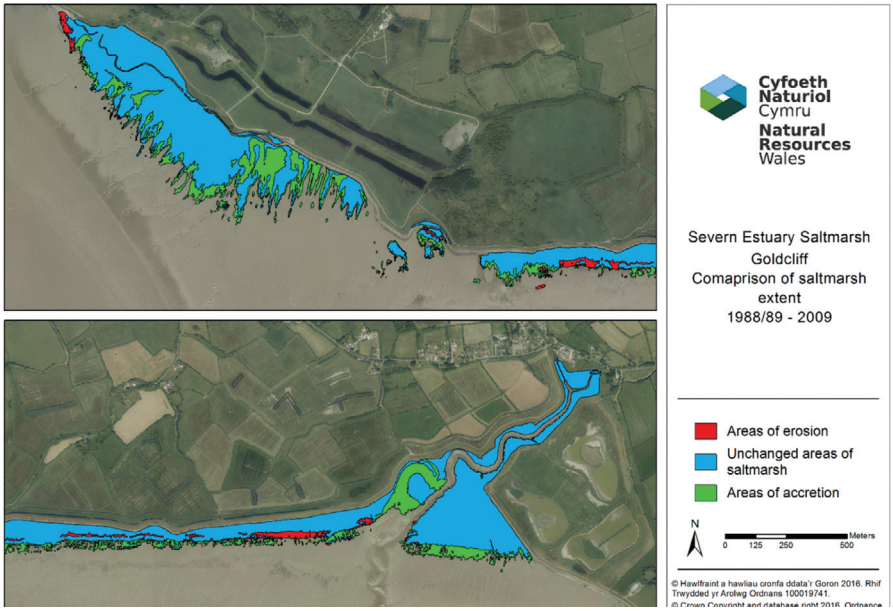

Figure 5. Map showing the change between 1988/89 and 2009 at Goldcliff. (Wilkinson *et al*. 2019).

Plover *Charadrius hiaticula*, 3 pairs of Little Ringed Plover *Charadrius dubius*. The following species nest mainly on lagoon islands 1 and 2 but also elsewhere around the lagoons: a maximum of 40 pairs of Redshank, 23 pairs of Lapwing and 6 pairs of Oystercatcher *Haematopus ostralegus*. Due to concerns around very poor survival rates of chicks, an electrified fence was installed around the lagoons in 2009. The fence is 2.2km long, 1.8 metres high and encircles the entire lagoon area.

Management

Becoming hypersaline or drying out completely is the greatest risk in most summers. For this reason, lagoon 3 was kept as a freshwater reservoir from 2007 to help control the level and salinities of the other two lagoons. From March to September the water level in lagoons 1 and 2 are kept low enough to allow short-legged waders such as Dunlin *Calidris alpina* to feed, whilst not allowing the shallow

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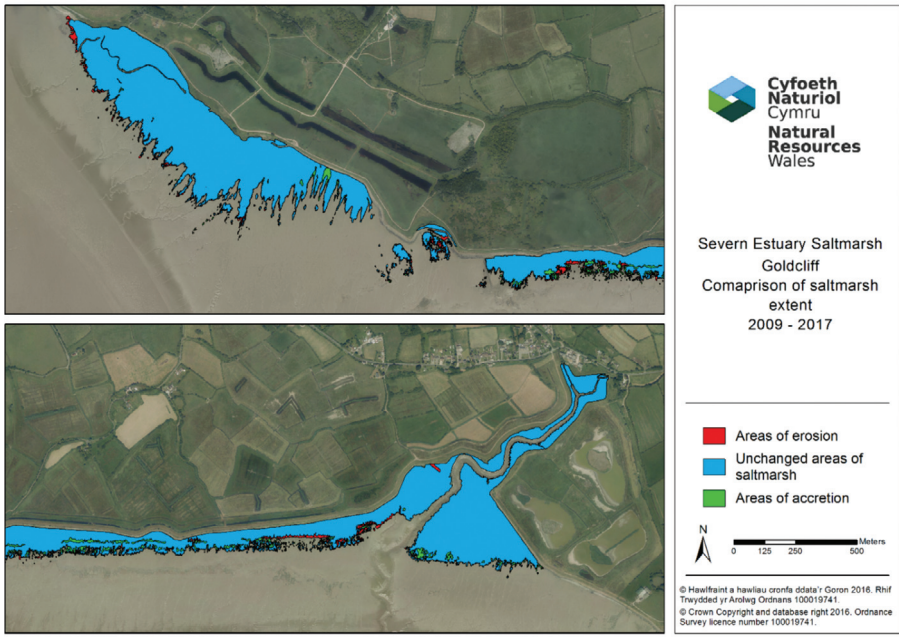
Cyfoeth Naturiol Cymru
Natural Resources Wales
Severn Estuary Saltmarsh
Goldcliff
Comaprison of saltmarsh extent
2009 - 2017
Areas of erosion
Unchanged areas of saltmarsh
Areas of accretion
N
0 125 250 500 Meters
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© Crown Copyright and database right 2016. Ordnance Survey licence number 100019741.

Figure 6. Map showing the change between 2009 and 2017 at Goldcliff. (Wilkinson *et al.* 2019).

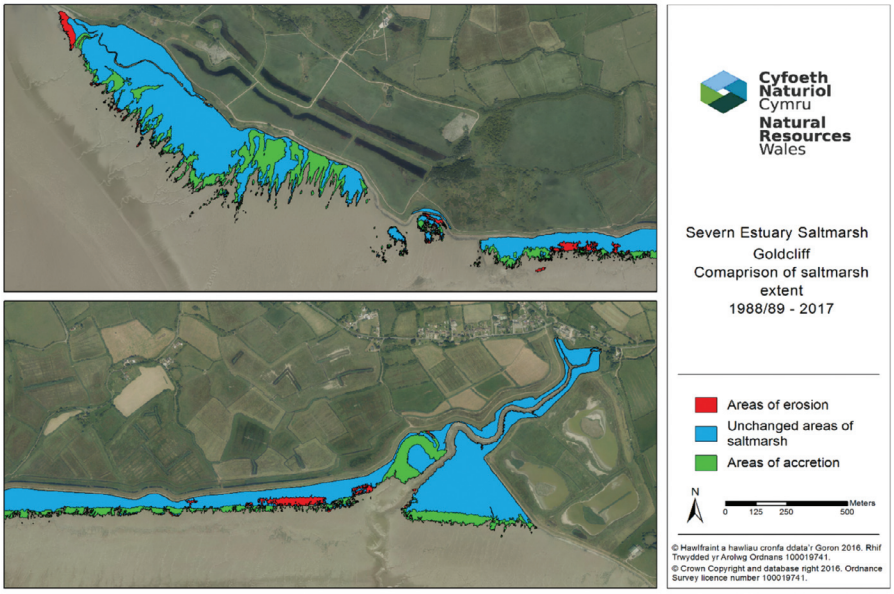
Cyfoeth Naturiol Cymru
Natural Resources Wales
Severn Estuary Saltmarsh
Goldcliff
Comaprison of saltmarsh extent
1988/89 - 2017
Areas of erosion
Unchanged areas of saltmarsh
Areas of accretion
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Figure 7. Map showing the change between 1988/89 and 2017 at Goldcliff. (Wilkinson *et al*. 2019).

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lagoon to dry up, potentially killing benthic invertebrates. This is achieved by releasing water from lagoon 3. Often additional fresh water is pumped from the grasslands, which may in turn have been let down from the reedbeds. From October to March the water level can rise in lagoons 1 and 2 as the principal driver is maintaining salinity targets. The lagoons function as a high tide roost during the winter but also offer good foraging opportunities for dabbling duck especially Shoveler. During September, when the risk of drought has usually abated, lagoon 3 is lowered to provide roosting and feeding habitat for migratory waders, particularly Black-tailed Godwit and Lapwing. During the winter the water level is increased to maximum in lagoon 3 to provide a reservoir for the other lagoons the following summer.

The aim for lagoons 1 and 2 is to keep the salinities between 6 and 15 parts per thousand all year round. This is to try to keep the salinity within the tolerance of the *Chironomid* larvae which make up the majority of the benthic invertebrate biomass. The salinity in lagoon 3 should not exceed 3 parts per thousand. Fresh water can be pumped onto the lagoons if the salinity is too high. Two one-metre diameter tidal flaps, one set one metre higher than the other, can be winched open to allow saline water from the Severn in. The salinity of this water varies depending on recent rainfall. Allowing the turbid Severn water in brings food species for wading birds like Ragworm *Hediste diversicolor* and also brings silt. As a result the lagoons fill with silt, and approximately 150 cubic metres of silt are removed by excavator every year. The grassland surrounding the lagoons is grazed in a similar way to the wet grasslands, only cattle are permitted within the electrified fence as they less likely to trample nests than are sheep (Green 1986). Due to the higher density of ground nesting Lapwing, Redshank and Skylark, stock are often shut out from fields, this can lead to issues with rank vegetation; rush growth is also dominant in some areas. Rank vegetation is cut and baled in August. The lagoon islands also require mowing annually in August to prevent scrub species becoming established.

Saltmarsh

Wilkinson *et al*. (2019) compared aerial data of the Severn salt meadows, including Newport Wetlands NNR from 1988/89, 2009 and 2017. They found that most changes occurred between 1988/89 and 2009. Overall the figures indicate that between the 1988/89 and the 2017 assessments there had been a net gain (around 13.34 ha) of saltmarsh within the NNR boundary.

Changes in vegetation community type and distribution

Wilkinson *et al*. (2019) compared a vegetation survey of the Severn saltmarsh in 1998 (Dargie 1998) with data collected in 2017. They discovered that the number of core habitats mapped was higher in 2017 than in 1998, and some vegetation communities were recorded in 1998 that were not seen in 2017, and *vice versa*. This is captured in Table 6.

Wilkinson *et al*. (2019) concluded that the increase in the number of communities recorded in 2017 could be due to an increase in diversity, or the interpretation of community types. Rodwell (2000) highlighted the problems of saltmarsh classification: "the occurrence of small numbers of species with varying abundance in a wide variety of habitats makes classification very difficult". The main differences were summarised as the increase in diversity of the western block and the abundance and frequency of Limonium spp. and *Armeria maritima* in the middle marsh of the central block.

Management

Dargie recorded this sector as being largely made up of un-grazed marsh at low and middle marsh levels, with evidence of some grazing of the central block and sheep grazing on the south side of

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	1998	2017
No. of core habitats mapped	**13**	**20 (including three sub-communities types not used by Dargie)**
Vegetation communities recorded in 2017 but not recorded in 1998	MG11 (*Festuca rubra - Agrostis stolonifera - Potentilla anserina* grassland), S4 (*Phragmites australis* reedbed), SM6 (*Cochlearia anglica* variant), SM10 (Transitional low marsh vegetation with *Puccinellia maritima*, annual *Salicornia* species and *Suaeda maritima*), SM13 (high forb-cover sub-community), SM13 (*Plantago maritima* foreshore sub-community), SM13c (*Limonium vulgare – Armeria maritima* sub-community) SM13x SM16b (*Juncus gerardii* dominant sub-community), SM28 (*Elymus repens* saltmarsh community).	
Vegetation communities recorded in 1998 but not recorded in 2017	SM16a (*Puccinellia maritima* sub-community) SM16d SM16e	

Table 6. Comparison of number and type of vegetation communities recorded at Goldcliff in 1998 and 2017. (Wilkinson *et al*. 2019).

Goldcliff Pill. The grazing has changed very little since the reserve's creation. The now diverse western block has been completely ungrazed. The central block is occasionally grazed by sheep, but in reality they only graze the eastern edge of the central block. The northern sections of Goldcliff Pill are grazed hard by sheep to create habitat for Wigeon and the southern side is grazed lightly by cattle.

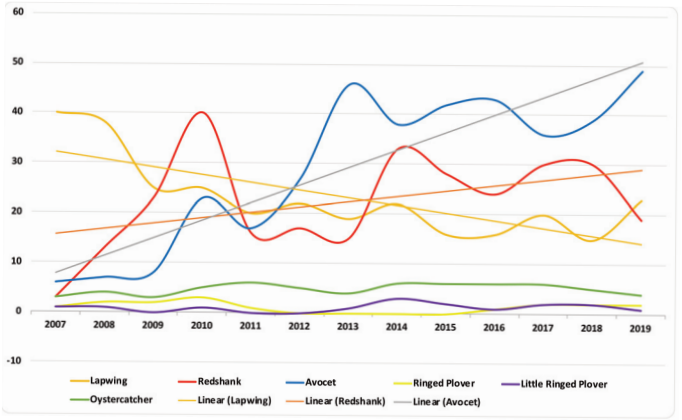
Breeding waders

Since 2007 the trend for the number of pairs of breeding Avocet and Redshank has increased and Lapwing numbers are decreasing. The numbers of breeding Oystercatcher, Ringed Plover and Little Ringed Plover have remained fairly constant (see Figure 8). Chick survival rate is particularly poor for Lapwing and Avocet (see Figure 9). To replace annual adult losses and have a sustainable population, Lapwings should produce around 0.6-0.97 fledglings per breeding pair each year (Peach *et al*. 1994; RSPB 2010), the average is 0.27 chicks per pair at Newport Wetlands.

Change in use of Newport Wetlands by Severn Estuary SPA waterfowl

The Severn Estuary SPA internationally important assemblage of waterfowl consists of the following species:

European White-fronted Goose *Anser albifrons albifrons* - only a handful of records on the NNR.
Bewick's Swan *Cygnus columbianus* - only a handful of records on the NNR.
Shelduck *Tadorna tadorna*
Shoveler
Gadwall *Mareca strepera*
Wigeon
Mallard *Anas platyrhynchos*
Pintail *Anas acuta*
Teal *Anas crecca*
Pochard *Aythya ferina*



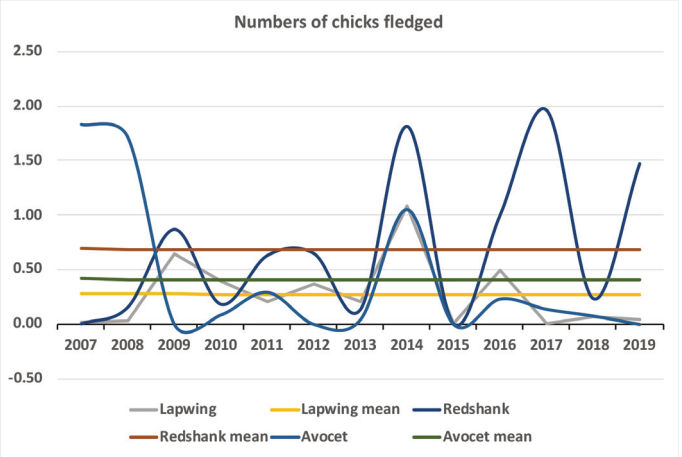
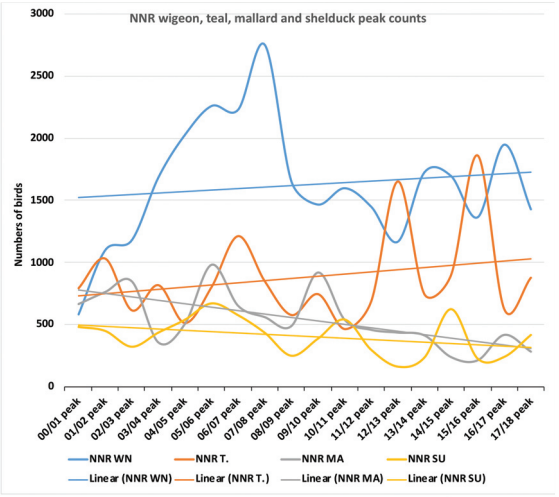


Figure 8. Breeding wader pairs (above).
Figure 9. Number of fledged wader chicks per pair (below).



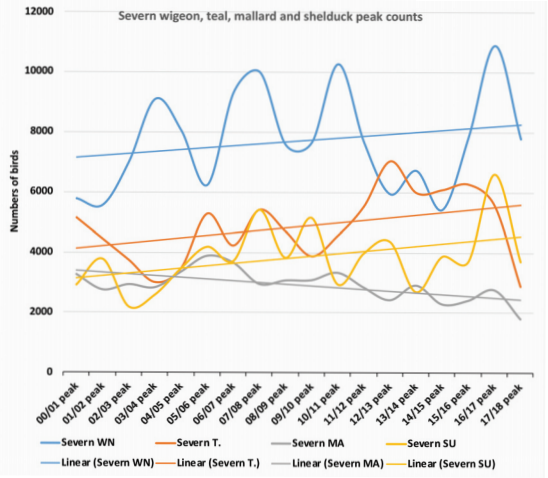


Figure 10. Peak counts of Wigeon, Teal, Mallard and Shelduck on the NNR (above) and on the Severn Estuary (below).

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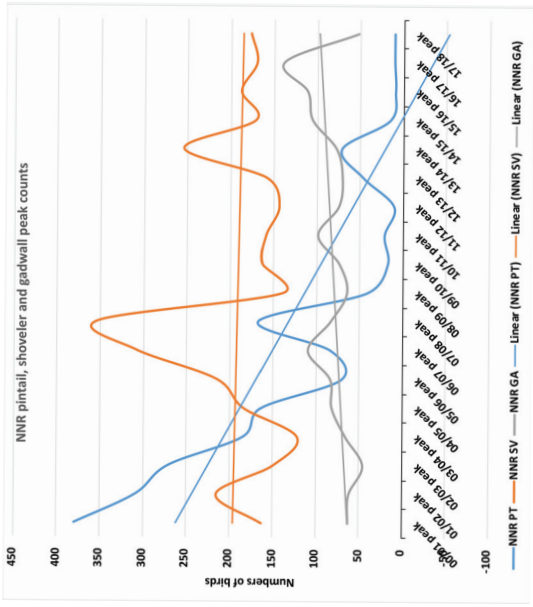


Figure 11. Peak counts of Pintail, Shoveler and Gadwall on the NNR (above) and on the Severn Estuary (below).

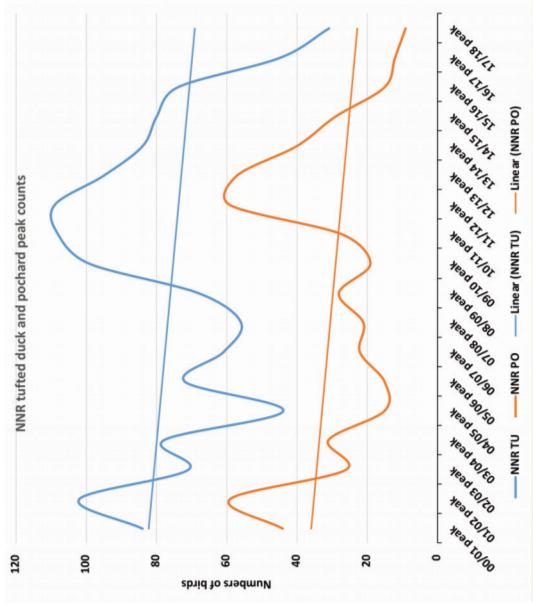
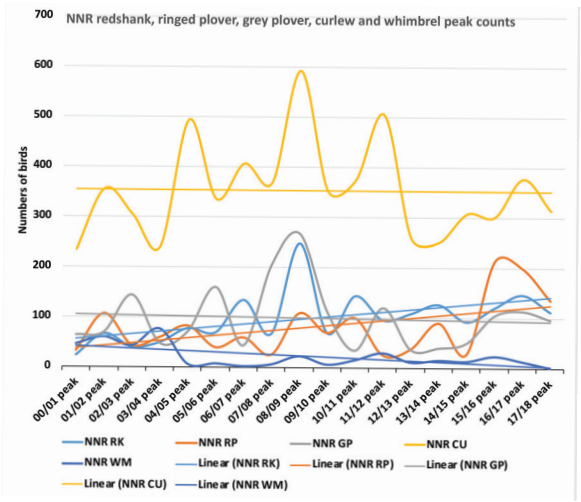


Figure 12. Peak counts of Tufted Duck and Pochard on the NNR (above) and on the Severn Estuary (below).

the Severn Estuary (below).



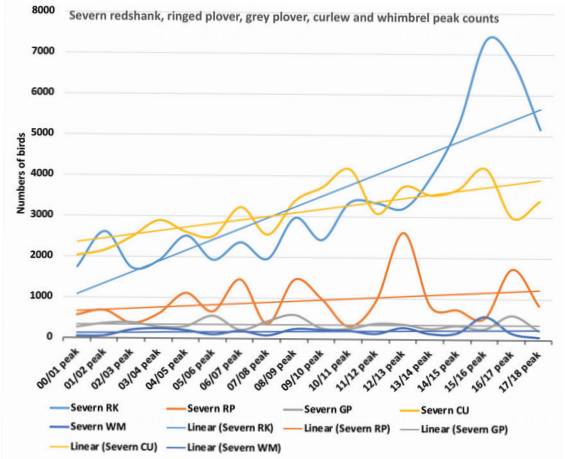
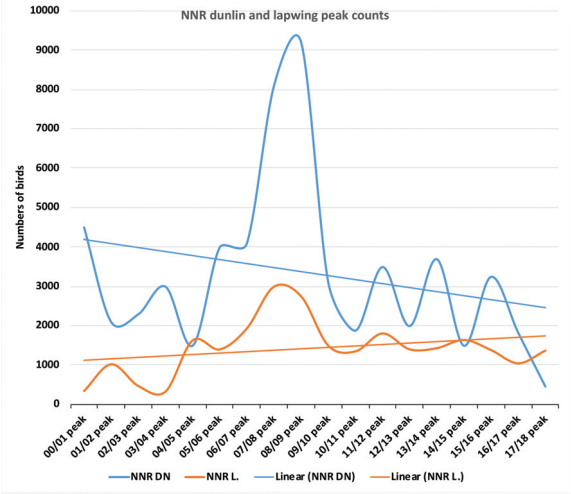


Figure 13. Peak counts of Redshank, Ringed Plover, Grey Plover, Curlew and Whimbrel on the NNR (above) and on the Severn Estuary (below).

Severn Estuary (below).



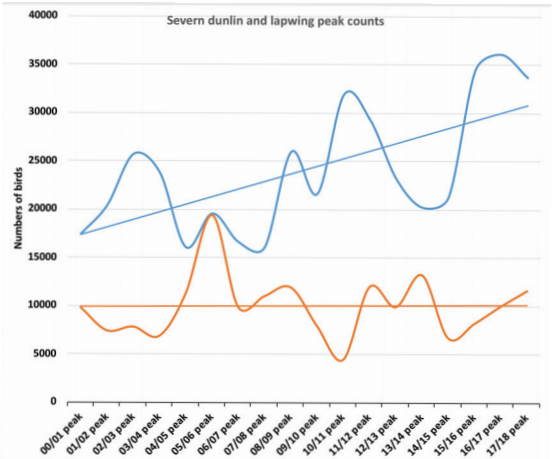


Figure 14. Peak counts of Dunlin and Lapwing on the NNR and on the Severn Estuary.

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Tufted Duck *Aythya fuligula*
Lapwing
Grey Plover *Pluvialis squatarola*
Ringed Plover
Whimbrel *Numenius phaeopus*
Curlew *Numenius arquata*
Dunlin
Redshank

Of the SPA surface feeding ducks' peak counts, Gadwall, Wigeon, Teal and Shoveler appear to be roughly stable or increasing. The UK trends since 2000 for Gadwall and Shoveler have been increasing, decreasing for Wigeon and approximately stable for Teal. Mallard are declining, following the wider Severn Estuary and national trend. Pintail have declined sharply since the reserve's creation (see Figures 10 and 11). They have declined nationally since 2000. Both diving duck species are in gradual decline on the NNR. Pochard are declining more slowly than on the wider Estuary, whilst Tufted Duck peak counts are increasing in the Severn Estuary WeBS count areas (Figure 12). Pochard numbers have been declining since 2000 and Tufted Duck numbers have been roughly stable.

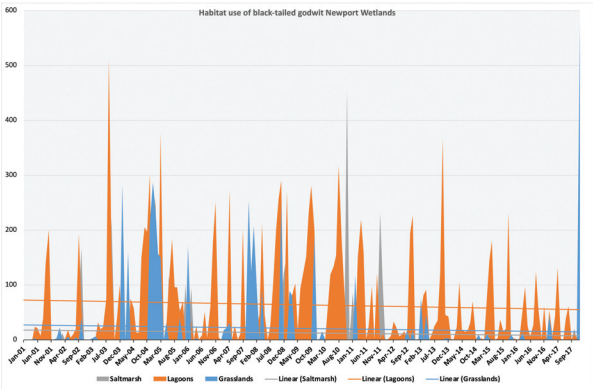

Figure 15. Habitat use of Black-tailed Godwit at Newport Wetlands.

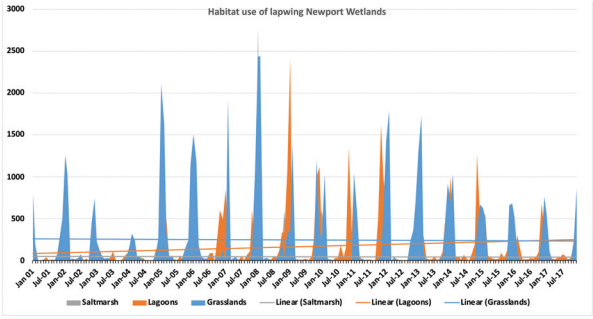

Figure 16. Habitat use of Lapwing Newport Wetlands.

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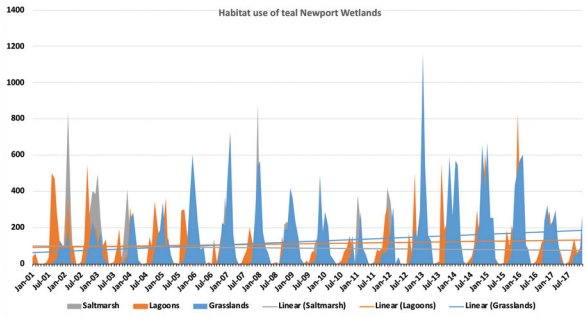

Figure 17. Habitat use of Teal at Newport Wetlands.

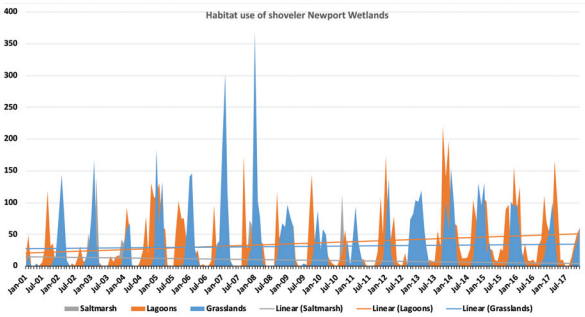

Figure 18. Habitat use of Shoveler at Newport Wetlands.

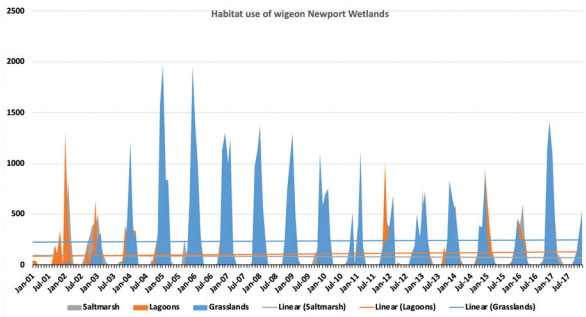

Figure 19. Habitat use of Wigeon at Newport Wetlands.

Of the SPA waders, peak counts of Redshank, Ringed Plover, Grey Plover, Curlew and Lapwing appear to be roughly stable or increasing in number, although their numbers appear to have been declining nationally since 2000. Whimbrel and Dunlin numbers appear to be declining on the reserve despite the Severn Estuary trend (Figures 13 and 14). Dunlin numbers have been declining nationally since 2000, whilst Whimbrel numbers appear to be increasing.

Peak counts of five species of waterfowl with habitat use from January 2001 to December 2017 are compared. Teal, Wigeon, Shoveler, Lapwing and Black-tailed Godwit have been selected, five species with different feeding methods and all species especially significant for Newport Wetlands. Teal, Wigeon, Shoveler and Lapwing all showed a fairly consistent use of the saltmarsh, a maintained or increasing use of the grasslands and an increase in the use of the saline lagoons over time. Black-tailed Godwit peak counts declined consistently across all habitat types. See Figures 15,16,17,18 and 19.

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Public engagement

Once the reserve was created and opened to the public, visitor numbers rose to approximately 20,000 a year. In 2008 the visitor centre opened and by 2012 visitor numbers approached 100,000. 2016 has been our busiest year so far with 118,476 visits. The RSPB have staff engaging with the public seven days a week. They run events and guided walks, and the centre education team engage directly with between 3,000 and 5,600 local school children every year.

Conclusions

The created habitats, the saline lagoons, reedbeds and flooded grasslands harbour far more wildlife than was originally there twenty years ago. The created habitats account for thirteen of the nineteen notified SSSI features. Of those features some are not in Favourable Conservation Status; of particular concern is the very low breeding productivity of Avocet and Lapwing. More work is required to ascertain the reason for this. Black-tailed Godwit numbers are in decline across the grasslands, saline lagoons and saltmarsh, whilst their numbers are increasing within the Severn Estuary WeBS count area.

The field ditch management seems to have gradually increased the diversity of the ditches in the first few years of the reserve becoming established. Newport Wetlands field ditches outperformed all the other Gwent Levels SSSI field ditch systems, by a significant margin, on every criteria measured in the 2017 survey (Murton *et al*. 2017). A further survey is required to compare present aquatic invertebrate abundance with the reserve baseline surveys.

The saltmarsh is now more diverse than it was in 1998 (Wilkinson *et al*. 2019). Some of the most diverse areas of mid-marsh are those that have not been grazed at all between surveys, suggesting further improvements in management are possible.

There have been over one million visits to Newport Wetlands since its creation. Most of the visits, approximately 90%, have been to the reedbed area. There is very little evidence that wildlife is being lost as a result. Marsh Harrier and Bittern have begun nesting in recent years. Water Vole have moved into the reedbeds and Otter sightings are more common.

Acknowledgements

Thanks to the staff and volunteers, past and present at NRW Newport Wetlands and the RSPB Visitor Centre. All the wildlife and visitor engagement achievements are the result of their work. I thank Dr Stephanie Tyler, who acted as referee, for her advice on the production of this paper.

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Bearded Tit at Newport Wetlands (John Marsh).

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Estimating the sizes of breeding populations of birds in Wales

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Crynodeb

Ers cyhoeddi trafodaethau'r Panel Amcangyfrif Poblogaeth Adar yn 1997 (APEP1) cyhoeddwyd tri amcangyfrif arall o faint poblogaethau adar sy'n nythu ac yn gaeafu ym Mhrydain. Yma, rydym yn defnyddio canlyniadau'r ddau ddiwethaf o'r rhain (APEP3 ac APEP4), ynghyd a data o *Atlas Adar 2007-11* a thueddiadau poblogaeth o'r Arolwg Adar Nythu i amcangyfrif maint poblogaeth 85 rhywogaeth sy'n nythu yng Nghymru.

Summary

Since the publication of the deliberations of the Avian Population Estimates Panel in 1997 (APEP1) there have been three other estimates of the population sizes of breeding and wintering species of bird in Great Britain. Here, we have used the results of the last two of these (APEP3 and APEP4), with data from *Bird Atlas 2007-11* and Breeding Bird Survey population trends to calculate estimates of the population sizes of 85 species that breed in Wales.

Background

During the last 25 years, the quality of information about breeding birds in Wales has improved greatly; in particular, robust trend information is now available for 60 species through the BTO/JNCC/RSPB Breeding Bird Survey (Harris *et al*. 2020). There is, however, limited information on the sizes of breeding bird populations.

Knowing the absolute number of birds is important for those who make decisions about nature conservation, both for policy and delivery on the ground. Such information can be used, for example, in assessments of conservation importance and of extinction risk, and in the implementation of site protection measures. Since 1997, the Avian Population Estimates Panel (APEP) has published a series of reports that quantify the population sizes of both breeding and wintering birds in Great Britain (GB) and in the United Kingdom. The first report was Stone *et al*. (1997), and Woodward *et al*. (2020) compiled the fourth such report, providing revised GB and UK population estimates up to 2016, but there has been no similar exercise for Wales.

Estimates for Wales have been made for the small number of species that have been surveyed under the Statutory Conservation Agency and RSPB Annual Breeding Bird Scheme (SCARABBS), and data have been collected for breeding seabirds through four seabird censuses, most recently the Seabirds Count project (2015-21). The only previous attempt to estimate the populations of other species

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was that made by Green (2002).

The purpose of this paper is to present new estimates for some Welsh breeding bird species. This is part of a project being undertaken by the Welsh Ornithological Society to publish The Birds of Wales (in prep.) in 2021.

Methods

We explored two approaches to generate an estimate for each regular breeding species in Wales. We used spatial data on distribution and abundance patterns from *Bird Atlas 2007-11* (Balmer *et al*. 2013), population trends of breeding birds in Wales from the UK Breeding Bird Survey (Harris *et al*. 2020) and population estimates made for Great Britain by APEP. The methods take different approaches to working out what proportion of the overall GB population estimate can be assigned to Wales and whether to further adjust for recent population changes in Wales. The most straightforward method to estimate the proportion of the GB population occurring in Wales is to determine the proportion of each species' GB range that falls in Wales, using the number of occupied 10-km squares inside and outside Wales from *Bird Atlas 2007-11*. Unfortunately, this calculation is only valid for species that occur at the same density across the whole of Britain, and *Bird Atlas 2007-11* shows that species generally have substantial spatial variation in abundance. This simple method would under-estimate the population size of any species that tends to occur at a higher density in Wales than in other parts of its British range (e.g. Nuthatch, Fig. 1a).

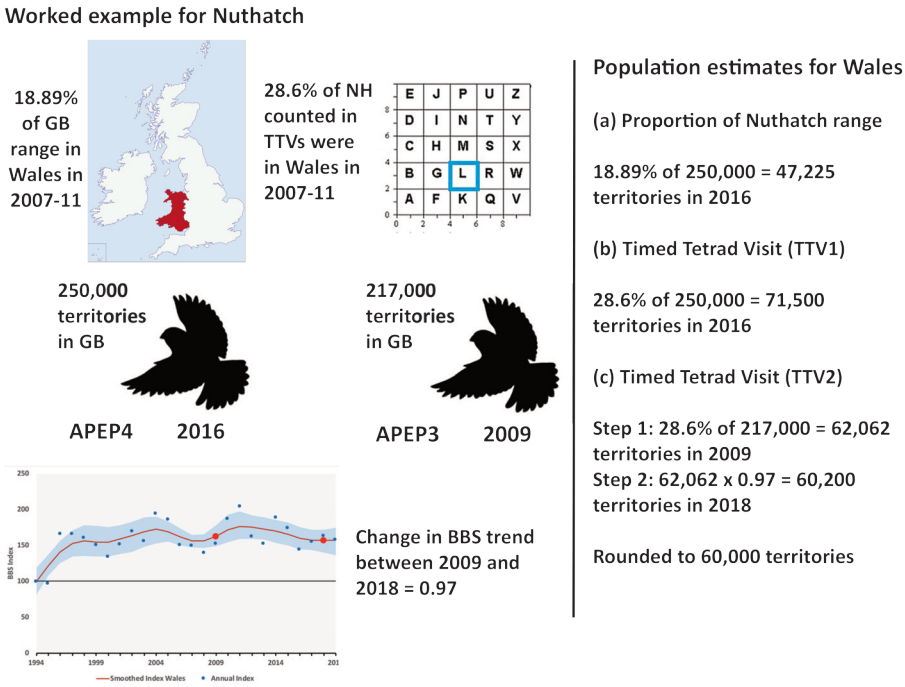
Worked example for Nuthatch
18.89% of GB range in Wales in 2007-11
28.6% of NH counted in TTVs were in Wales in 2007-11
E J P U Z
D I N T Y
C H M S X
B G L R W
A F K Q V
250,000 territories in GB
APEP4 2016
217,000 territories in GB
APEP3 2009
Change in BBS trend between 2009 and 2018 = 0.97
Population estimates for Wales
(a) Proportion of Nuthatch range
18.89% of 250,000 = 47,225 territories in 2016
(b) Timed Tetrad Visit (TTV1)
28.6% of 250,000 = 71,500 territories in 2016
(c) Timed Tetrad Visit (TTV2)
Step 1: 28.6% of 217,000 = 62,062 territories in 2009
Step 2: 62,062 x 0.97 = 60,200 territories in 2018
Rounded to 60,000 territories

Figure 1. A worked example showing the three population estimation methods for Nuthatch (scientific names for species appear in Tables 1, 2 or 3).

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A more sophisticated approach is to use spatial variation in abundance to determine the proportion of overall abundance found in Wales. For this we used information from Timed Tetrad Visits (TTV) undertaken during Bird Atlas 2007-11. A Timed Tetrad Visit was when an observer counted all individuals of all species identified, by sight or sound, during one hour, when walking through the habitats within a tetrad. For a selection of tetrads in each 10-km square, these provide a figure for the number of individuals detected per hour; see Chapter 4.4 of Balmer *et al*. (2013) for a more complete description of how these were undertaken. For each species, we calculated the average number of birds detected on TTVs (i.e. birds per hour of survey) for each occupied 10-km square. Summing these across Wales and GB allows an estimate to be made of the proportion of overall abundance in Wales. The 95% confidence limits were calculated for these values by boot strapping (i.e. repeating the process 200 times using randomised subsets of the underlying TTV data in each 10-km square).

We used these figures in one of two ways:
TTV method 1 (Fig. 1b): we multiplied the APEP4 (Woodward *et al*. 2020) population estimate for GB by the proportion of GB abundance in Wales. This method accounts for differences in densities between Wales and the rest of GB during 2007-11. However, the APEP4 estimates for GB are generally for 2016, having used long-term population trends (Common Birds Census and BBS; Massimino *et al*. 2017) to adjust upwards or downwards older population estimates to reflect recent UK-level trends. If population trends differed between Wales and the rest of GB in the intervening period (i.e. 1990 to 2016), our estimates of the proportion of the GB population in Wales may be wrong, leading to errors in our derived Welsh population estimates.

TTV method 2 (Fig. 1c): to overcome this problem we developed a two-step method that used the same TTV data from *Bird Atlas 2007-11* but with population estimates from APEP3 (Musgrove *et al*. 2013). These were derived for 2009, coincident with the atlas fieldwork so do not suffer from the mismatch described above. The first step of this method involved multiplying the 2009 GB population estimate by the proportion of abundance in Wales from the Bird Atlas data, giving a Welsh population estimate for 2009. The second step was to update these figures to 2018 using the population trends for Wales from BBS (Harris *et al*. 2020). Specifically, the ratio of change in the smoothed index value for 2009 and 2018 was multiplied by the 2009 Wales estimate to give a 2018 Wales estimate. This method is only possible for species with a robust population trend in Wales. For this purpose, we used trends for species that occurred in 30 or more BBS squares during that period. The criterion of 30 was adopted as that is the number of squares with data used to generate an annual population index for Wales (e.g. Harris *et al*. 2020).

APEP3 published some estimates without 95% confidence intervals and we have followed that practice. Where APEP3 and APEP4 presented such confidence intervals we multiplied the confidence intervals of the GB estimate by the proportion of abundance in Wales. APEP3 and APEP4 both published estimates based on the numbers of pairs, territories, females or males. We have adopted the same units.

Anomalies
For a small number of species (e.g. Pied Flycatcher), neither APEP3 nor APEP4 made a precise point estimate but showed a range. For these species, the methods above were adjusted slightly, multiplying the lower limit of the GB population estimate with the lower confidence interval value for the proportion of abundance in Wales, and repeating that for the upper value. For these species, the Welsh population estimate is expressed only as a range.

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Exclusion filters

The output from each method was produced for each regularly occurring species. We then assessed whether and how to use the outputs through a four-stage filter for each species:

i. Is there an existing population estimate made using more rigorous survey methods, such as seabird censuses and SCARABBS? This removed 34 species from consideration (see Table 1).

ii. Does the behaviour of the species mean that the TTV method used in Bird Atlas 2007-11 might provide a poor indication of abundance, especially when scaled down to country level? This removed four nocturnal owl species from consideration (see Table 2).

iii. Did the species occur in fewer than 50 of the 10-km squares in Wales? This is around 20% of the 10-km squares. In many instances the species occurred in only a small number of tetrads, potentially just one, within a 10-km square. Examples were Eider, Quail and Garganey. This removed 18 species from consideration (see Table 2).

iv. Was the distribution very unevenly spread across Wales, usually because of the uneven and irregular availability of suitable nesting habitat, or because it is colonial? This removed Oystercatcher, Grey Heron, Little Egret and Sand Martin from consideration (see Table 2). Had we not already removed colonial seabirds in stage i), those too would have been removed here because TTVs perform poorly for strongly aggregated species, especially those around the coast and on islands.

Data accuracy

The TTV methods should lead to the most accurate estimates achievable without undertaking a species-specific census or bespoke analyses of density data, however they are subject to several possible errors.

i. Musgrove *et al*. (2013) and Woodward *et al*. (2020) assessed the reliability of their estimates. These are the best data available as GB baselines and we have shown their reliability scores in Table 3.

ii. The proportion of a species' relative abundance that was applied to Wales based on Bird Atlas 2007-11 may have been incorrect. This could arise, for example, if the sample of tetrads in each 10-km square surveyed for TTVs was biased towards the habitat of a species in Wales or biased against its habitat outside Wales. It could also occur if observers in Wales were better at counting birds than observers in the rest of Great Britain. There is no reason to suspect that either of these biases occurred in the Atlas.

iii. For method TTV2 we are confident of the accuracy of the published BBS trends for Wales (e.g. Harris *et al*. 2020) for species that occur on a minimum of 30 1-km squares. For species that are recorded in fewer than 30 squares, we chose to present results using method TTV1. The method selected for each species is shown in Table 3.

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Results and discussion

The population estimates are based on assessment of 85 species (Table 3). The estimates are rounded to two-and-a-half significant figures to conform to the same practice as Woodward *et al*. (2020).[1]

The most abundant species in Wales in 2018 was Wren, with 1.3 million territories. Three others had populations in excess of 500,000: Robin (905,000 pairs), House Sparrow (800,000 pairs) and Blackbird (665,000 pairs). Willow Warbler and Blackcap (each 265,000 territories) were the only migratory species to occur in the list of the 10 most populous species (See Table 3). Manx Shearwater *Puffinus puffinus* is alone among the species not presented here that is among the top 10.

Producing a population estimate for Wales that can be compared to that for the whole of Britain allows an assessment of the species for which Wales is particularly important as a breeding species. As context, Wales accounts for approximately 8.5% of the landmass of Britain. From this selection of 85 species, Wales holds more than 25% of the British population of six species: Pied Flycatcher (69-76%), Goshawk (50%), Wood Warbler (44%), Redstart (37%), Red Kite (30%) and Garden Warbler (28%). Other species not assessed in these estimates (e.g. Chough *Pyrrhocorax pyrrhocorax*, Manx Shearwater) also occur in numbers above this threshold.

The estimates presented here have been produced by a different method to those in Green (2002). The limited method details provided there, implied that those drew on the British breeding population estimates made in the *New Atlas of Breeding Birds in Britain and Ireland: 1988-1991* (Gibbons *et al*. 1993), factored for the proportion of the species' range in Wales and updated using the population change information from the Breeding Bird Survey during 1994-99. That is an approach that we explored but disregarded as likely to be less accurate than using the proportion of abundance. It is, thus, important that comparisons are not made (e.g. apparent population changes) between the earlier estimates and those made in this paper.

Conclusions

These estimates are a potential contribution to any future attempt to produce population estimates for all species in Wales, which could also be extended to the non-breeding season. Whether such an effort is worthwhile will depend on the likely use of the data in conservation decision-making, although population figures are in themselves of interest to the birdwatching community. They are also repeatable, if the GB estimates are updated by APEP or using new Atlas data. For that reason, the spreadsheet with the calculations is archived at **https://birdsin.wales/population-estimates-for-wales-2020/**

Our analysis excluded 34 species (filter i) that we considered to be covered by other surveys (Table 1), although a lack of funding means that most species covered by SCARABBS have no forward plan to ensure these are repeated. The 26 species excluded under filters (ii), (iii) and (iv) also merit improved methods to estimate their populations, especially as many are species of conservation concern or their localised occurrence increases the risk of loss from all, or part of, Wales.

The forthcoming publication of *The Birds of Wales* will use expert opinion and local surveys to guesstimate the populations of a number of these, and several others are monitored by the Rare

[1] With two-and-a-half significant figures, the following examples show the rounding; 22,712 becomes 22,500; 758,674 becomes 760,000 and 1,106,220 becomes 1,100,000.

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Breeding Birds Panel (RBBP), although there can be high variation in counts between years according to the level of effort by observers. There are several species for which more dedicated survey would produce meaningful population estimates. Priorities for these in Wales were described by Thorpe and Brenchley (2017).

Planning for the next breeding Atlas will get underway in the next few years, and we hope that birdwatchers in Wales will play an active role in data collection for that project. In the meantime, we would urge birdwatchers to engage in regular BBS fieldwork to improve our knowledge of the population trends in Wales for as many species as possible. We would hope that new population estimates could result from these efforts, and that population estimates could, in future, be presented for the constituent nations of Britain.

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English name	Scientific name	Source of most recent population
Black Grouse	*Lyrurus tetrix*	Sim *et al*. 2008
Nightjar	*Caprimulgus europaeus*	Conway *et al*. 2007
Lapwing	*Vanellus vanellus*	Hughes in prep.
Golden Plover	*Pluvialis apricaria*	Johnstone *et al*. 2008
Ringed Plover	*Charadrius hiaticula*	Conway *et al*. 2008
Little Ringed Plover	*Charadrius dubius*	Conway *et al*. 2008
Curlew	*Numenius arquata*	Taylor *et al*. 2020
Dunlin	*Calidris alpina*	Johnstone *et al*. 2008
Kittiwake	*Rissa tridactyla*	Mitchell *et al*. 2004
Black-headed Gull	*Chroicocephalus ridibundus*	Mitchell *et al*. 2004
Mediterranean Gull	*Ichthyaetus melanocephalus*	Mitchell *et al*. 2004
Great Black-backed Gull	*Larus marinus*	Mitchell *et al*. 2004
Herring Gull	*Larus argentatus*	Mitchell *et al*. 2004
Lesser Black-backed Gull	*Larus fuscus*	Mitchell *et al*. 2004
Common Tern	*Sterna hirundo*	Mitchell *et al*. 2004
Common Guillemot	*Uria aalge*	Mitchell *et al*. 2004
Razorbill	*Alca torda*	Mitchell *et al*. 2004
Black Guillemot	*Cepphus grylle*	Mitchell *et al*. 2004
Puffin	*Fratercula arctica*	Mitchell *et al*. 2004
Fulmar	*Fulmarus glacialis*	Mitchell *et al*. 2004
Shag	*Phalacrocorax aristotelis*	Mitchell *et al*. 2004
Cormorant	*Phalacrocorax carbo*	Mitchell *et al*. 2004
Osprey	*Pandion haliaetus*	Welsh Bird Report 2018
Hen Harrier	*Circus cyaneus*	Wotton *et al*. 2018
Merlin	*Falco columbarius*	Ewing *et al*. 2007
Peregrine	*Falco peregrinus*	Williams 2018
Chough	*Pyrrhocorax pyrrhocorax*	Hayhow *et a*l. 2014
Willow Tit	*Poecile montanus*	Wotton, in prep.
Dartford Warbler	*Sylvia undata*	Wotton and Conway 2008
Ring Ouzel	*Turdus torquatus*	Wotton *et al*. 2016
Whinchat	*Saxicola rubetra*	Henderson *et al*. 2017
Stonechat	*Saxicola rubicola*	Henderson *et al*. 2017
Wheatear	*Oenanthe oenanthe*	Henderson *et a*l. 2017
Twite	*Linaria flavirostris*	Wilkinson *et al*. 2018

Table 1. Species (34) for which other methods have estimated population size in Wales.

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English name	Scientific name	10km sq occupied in Wales 2007-11	Reason for exclusion
Grey Partridge	*Perdix perdix*	32	Fewer than 50 occupied 10-km squares in Wales; may include some released birds
Quail	*Coturnix coturnix*	48	Fewer than 50 occupied 10-km squares in Wales
Mandarin Duck	*Aix galericulata*	26	Fewer than 50 occupied 10-km squares in Wales
Garganey	*Spatula querquedula*	8	Fewer than 50 occupied 10-km squares in Wales
Shoveler	*Spatula clypeata*	23	Fewer than 50 occupied 10-km squares in Wales
Gadwall	*Mareca strepera*	33	Fewer than 50 occupied 10-km squares in Wales
Pochard	*Aythya ferina*	20	Fewer than 50 occupied 10-km squares in Wales
Eider	*Somateria mollissima*	7	Fewer than 50 occupied 10-km squares in Wales
Red-breasted Merganser	*Mergus serrator*	37	Fewer than 50 occupied 10-km squares in Wales
Turtle Dove	*Streptopelia turtur*	4	Fewer than 50 occupied 10-km squares in Wales
Oystercatcher	*Haematopus ostralegus*	106	Uneven distribution
Woodcock	*Scolopax rusticola*	28	Fewer than 50 occupied 10-km squares in Wales
Redshank	*Tringa totanus*	27	Fewer than 50 occupied 10-km squares in Wales
Grey Heron	*Ardea cinerea*	170	Colonial
Little Egret	*Egretta garzetta*	27	Colonial
Honey-buzzard	*Pernis apivorus*	-	Fewer than 50 occupied 10-km squares in Wales
Barn Owl	*Tyto alba*	156	Nocturnal
Tawny Owl	*Strix aluco*	228	Nocturnal
Little Owl	*Athene noctua*	81	Nocturnal
Long-eared Owl	*Asio otus*	10	Nocturnal
Sand Martin	*Riparia riparia*	195	Colonial
Cetti's Warbler	*Cettia cetti*	47	Fewer than 50 occupied 10-km
Firecrest	*Regulus ignicapilla*	9	Fewer than 50 occupied 10-km
Tree Sparrow	*Passer montanus*	48	Fewer than 50 occupied 10-km
Yellow Wagtail	*Motacilla flava*	19	Fewer than 50 occupied 10-km
Hawfinch	*Coccothraustes coccothraustes*	19	Fewer than 50 occupied 10-km squares in Wales

Table 2. Species (26) for which it was decided that we were unable to estimate their population sizes. The reasons for exclusion are shown.

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English name	Scientific name	TTV method	units	10km sq occupied in Wales	Wales population estimate	Estimate (lower CI)	Estimate (upper CI)	Rel.
Red Grouse	*Lagopus lagopus*	1	P	55	835	490	1,450	3
Red-legged Partridge	*Alectoris rufa*	1	T	77	1,400	940	1,850	2
Pheasant	*Phasianus colchicus*	1	F	244	165,000	160,000	175,000	2
Canada Goose	*Branta canadensis*	2	P	219	8,850	-	-	3
Greylag Goose	*Anser anser*	1	P	111	1,650	965	2,050	3
Mute Swan	*Cygnus olor*	1	P	140	485	400	585	2
Shelduck	*Tadorna tadorna*	1	P	88	1,250	725	2,250	3
Mallard	*Anas platyrhynchos*	2	P	258	-	4,600	11,000	3
Teal	*Anas crecca*	1	P	70	-	60	250	3
Tufted Duck	*Aythya fuligula*	1	P	103	-	765	1,350	3
Goosander	*Mergus merganser*	1	P	121	685	565	855	2
Swift	*Apus apus*	2	P	238	4,100	3,000	5,250	3
Cuckoo	*Cuculus canorus*	2	P	218	1,900	1,000	2,750	3
Rock Dove	*Columba livia*	2	P	178	41,000	33,500	49,000	2
Stock Dove	*Columba oenas*	2	T	192	21,500	-	-	2
Woodpigeon	*Columba palumbus*	2	P	259	295,000	280,000	315,000	2
Collared Dove	*Streptopelia decaocto*	2	P	247	87,000	78,000	95,500	2
Water Rail	*Rallus aquaticus*	1	T	56	215	110	315	2
Moorhen	*Gallinula chloropus*	1	T	203	14,500	13,500	15,500	2
Coot	*Fulica atra*	1	P	139	1,600	1,250	2,050	3
Little Grebe	*Tachybaptus ruficollis*	1	P	148	-	240	640	2
Great Crested Grebe	*Podiceps cristatus*	1	P	84	270	210	370	2
Snipe	*Gallinago gallinago*	1	P	103	1,100	820	1,400	3
Common Sandpiper	*Actitis hypoleucos*	1	P	114	490	395	565	2
Sparrowhawk	*Accipiter nisus*	1	P	245	2,950	2,700	3,200	2
Goshawk	*Accipiter gentilis*	1	P	120	310	260	350	2
Red Kite	*Milvus milvus*	2	P	175	1,350	-	-	2
Buzzard	*Buteo buteo*	2	P	255	-	9,850	13,500	2
Kingfisher	*Alcedo atthis*	1	P	138	-	445	970	3
Lesser Spotted Woodpecker	*Dryobates minor*	1	P	70	-	105	320	3
Great Spotted Woodpecker	*Dendrocopos major*	2	P	247	21,500	19,500	23,500	2
Green Woodpecker	*Picus viridis*	2	P	162	3,350	3,000	3,750	2
Kestrel	*Falco tinnunculus*	1	P	214	1,750	1,550	1,900	2
Hobby	*Falco subbuteo*	1	P	83	205	160	265	2
Jay	*Garrulus glandarius*	2	T	240	35,500	-	-	2
Magpie	*Pica pica*	2	T	258	79,500	-	-	2
Jackdaw	*Coloeus monedula*	2	P	256	155,000	135,000	175,000	2
Rook	*Corvus frugilegus*	2	P	236	35,500	28,500	37,500	2

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English name	Scientific name	TTV method	units	10km sq occupied in Wales	Wales population estimate	Estimate (lower CI)	Estimate (upper CI)	Rel.
Carrion Crow	*Corvus corone*	2	T	261	160,000	-	-	2
Raven	*Corvus corax*	2	P	258	2,150	-	-	3
Coal Tit	*Periparus ater*	2	T	247	75,000	-	-	2
Marsh Tit	*Poecile palustris*	1	T	152	4,850	4,400	5,300	2
Blue Tit	*Cyanistes caeruleus*	2	T	258	415,000	-	-	2
Great Tit	*Parus major*	2	T	257	255,000	-	-	2
Skylark	*Alauda arvensis*	2	T	258	115,000	-	-	2
Swallow	*Hirundo rustica*	2	T	258	82,000	-	-	2
House Martin	*Delichon urbicum*	2	P	258	67,500	47,500	87,500	2
Long-tailed Tit	*Aegithalos caudatus*	2	T	244	28,000	-	-	2
Wood Warbler	*Phylloscopus sibilatrix*	1	M	161	2,850	2,650	3,100	3
Willow Warbler	*Phylloscopus trochilus*	2	T	255	265,000	-	-	2
Chiffchaff	*Phylloscopus collybita*	2	T	258	245,000	-	-	2
Sedge Warbler	*Acrocephalus schoenobaenus*	1	T	207	19,500	17,500	21,500	2
Reed Warbler	*Acrocephalus scirpaceus*	1	P	108	11,000	8,700	13,500	2
Grasshopper Warbler	*Locustella naevia*	1	T	203	2,000	1,800	2,200	3
Blackcap	*Sylvia atricapilla*	2	T	253	265,000	-	-	2
Garden Warbler	*Sylvia borin*	2	T	241	39,500	-	-	2
Lesser Whitethroat	*Sylvia curruca*	1	T	152	6,950	6,150	7,800	2
Whitethroat	*Sylvia communis*	2	T	255	79,500	-	-	2
Goldcrest	*Regulus regulus*	2	T	250	85,500	-	-	2
Wren	*Troglodytes*	2	T	260	1,300,000	-	-	2
Nuthatch	*Sitta europaea*	2	T	238	60,000	-	-	2
Treecreeper	*Certhia familiaris*	2	T	232	37,500	-	-	2
Starling	*Sturnus vulgaris*	2	P	225	90,000	79,000	100,000	2
Blackbird	*Turdus merula*	2	P	260	665,000	635,000	695,000	2
Song Thrush	*Turdus philomelos*	2	T	254	160,000	-	-	2
Mistle Thrush	*Turdus viscivorus*	2	T	248	26,000	-	-	2
Spotted Flycatcher	*Muscicapa striata*	1	T	225	5,700	5,300	6,050	3
Robin	*Erithacus rubecula*	2	T	260	905,000	-	-	2
Pied Flycatcher	*Ficedula hypoleuca*	1	P	171	-	15,000	19,000	3
Redstart	*Phoenicurus phoenicurus*	2	P	192	50,500	36,500	65,000	2
Dipper	*Cinclus cinclus*	1	P	200	-	1,150	4,050	2
House Sparrow	*Passer domesticus*	2	P	258	800,000	725,000	870,000	2
Dunnock	*Prunella modularis*	2	T	261	310,000	-	-	2
Grey Wagtail	*Motacilla cinerea*	2	P	227	5,950	-	-	3
Pied Wagtail	*Motacilla alba*	2	P	259	56,000	49,000	63,500	2

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English name	Scientific name	TTV method	units	10km sq occupied in Wales	Wales population estimate	Estimate (lower CI)	Estimate (upper CI)	Rel.
Meadow Pipit	*Anthus pratensis*	2	P	251	170,000	150,000	195,000	2
Tree Pipit	*Anthus trivialis*	2	P	175	16,500	10,500	22,500	2
Chaffinch	*Fringilla coelebs*	2	T	258	470,000	-	-	2
Bullfinch	*Pyrrhula pyrrhula*	2	T	246	29,500	-	-	2
Greenfinch	*Chloris chloris*	2	P	255	38,000	35,500	40,500	2
Linnet	*Linaria cannabina*	2	T	258	47,500	-	-	2
Goldfinch	*Carduelis carduelis*	2	P	260	180,000	160,000	195,000	2
Siskin	*Spinus spinus*	2	P	219	58,500	-	-	3
Yellowhammer	*Emberiza citrinella*	1	T	168	31,500	29,000	33,500	2
Reed Bunting	*Emberiza schoeniclus*	2	T	231	17,500	-	-	2

Table 3. Population estimates for 85 species that breed in Wales. The method used is shown as TTV1 (2016) or TTV2 (2018). Units: P (pairs), F (females), M (males) or T (territories). Rel. is the reliability score for each species - 1 (good) to 3 (poor) - from Musgrove *et al*. (2013) or Woodward *et al*. (2020) as appropriate. The nine most abundant species, apart from Manx Shearwater, are named in bold.

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Long-term agression towards humans in a Buzzard (*Buteo buteo*)

There have been a number of reports of Buzzard exhibiting aggressive behaviour towards humans in Wales, for example Driver (2004) and Moore (2005). The following is an example of attacks of this kind, presumably by the same bird, over a period of at least six years.

Attacks on humans by the male bird of a pair of Buzzards breeding near Pentir, Caernarfonshire, have been recorded during the breeding season every year between 2014 and 2019. The nest is close to a minor road, and I have had reports of several passers-by each year being attacked by the bird. Many of the attacks involve persistent stoops at the head, without making physical contact, but a number of people have been struck around the head hard enough to draw blood. At least one person suffered extensive lacerations of the scalp causing considerable bleeding.

People attacked by the bird appear to be exclusively pedestrians; I have not heard of any attacks on cyclists or horse riders, who also regularly pass the nest area. The majority of those attacked appear to be joggers rather than walkers. A number of local joggers have changed their regular routes to avoid the bird.

Rhion Pritchard

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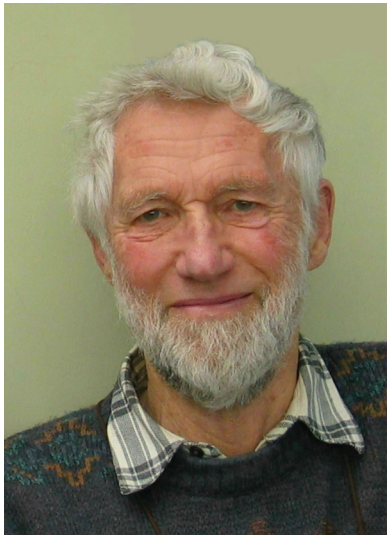

Peter Hope Jones (Fred Schlesinger)

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Obituary
Peter Hope Jones, 1935-2020

Welsh ornithology and nature conservation lost an influential and highly productive figure with the death of Peter Hope Jones on 13 July 2020, aged 85. Peter (or Peter Hope as he always announced himself) combined the precision of a scientist with a poetic sensibility. He influenced a generation of naturalists as much through his unique combination of personal qualities as through his work. He exhibited a vulnerability born of his struggles with depression, an engaging and giving personality, always looking for things to do for others and a thoughtfulness which connected the detail of any subject under discussion with a holistic and philosophical turn of mind.

Peter was brought up in Prestatyn, close to the mouth of the Dee estuary. His mother Menna came from Llanrhaeadr-ym-Mochnant, where his father Stan worked for the Midland Bank until he was called up for war service. Peter's secondary education was at Rhyl Grammar School. He had a clear tenor voice, and one year trained and conducted his House Choir in the school Eisteddfod. Out of school he 'lived on his bike', and took up birdwatching, influenced by finding Edmund Sandars' Bird Book for the Pocket on his Taid's shelves. Several close school friends also enjoyed the outdoor life with him, and he spent many school holidays with his mother's relatives on farms near Llanrhaeadr. In October 1953 he arrived at UCNW Bangor to study Forestry. There, he soon became involved with the Bangor Bird Group, and began wildfowl counts on Anglesey's lakes and estuaries. He also played hockey for the College 1st XI, and in later years had trials for the Welsh team. Sadly, he suffered from clinical depression near the end of his second year and had to drop out.

In March 1956 he became Assistant Warden at the Observatory on Fair Isle, where the Warden, Peter Davis, had just arrived from Skokholm. Peter Hope completed two seasons on Fair Isle, gaining an excellent grounding in ornithology, especially ringing and migration studies. His next posting, in 1958, was as a volunteer in the Camargue, helping with the ringing work at the Tour du Valat Research Station, owned and run by Dr Luc Hoffmann. This included some weeks in the Swiss Alps and on the Spanish coast. In June 1960 Peter was appointed the Nature Conservancy's Warden Naturalist for Newborough Warren, where his work included protecting breeding Montagu's Harriers. He became friendly with the wildlife artist Charles Tunnicliffe, finding recently dead birds on the beaches for Charles to use as specimens for his illustrations and paintings. He also befriended Jill Wild who visited Newborough with a Conservation Corps group, and they married in 1964. The following year Peter moved to Meirionnydd as Warden Naturalist, with nine National Nature Reserves under his wing. He monitored their bird populations and published the results. He even found time to join, and help run, the local Mountain Rescue Team. In 1968 he was awarded a Winston Churchill Memorial Award, which enabled him to spend two months in the USA studying wildlife conservation and management.

His work for NCC came to an abrupt end around 1973 when Jill asked for a divorce, and the resultant stress caused his resignation. His book Birds of Merioneth, published by the Cambrian Ornithological Society in 1974, was the first county avifauna for Meirionnydd, and this was followed in 1976 by Birds of Caernarvonshire, written with Peter Dare, again the first avifauna for the county. In 1976 he was appointed by RSPB as a seabird ecologist on Orkney, where he established a set of cliff sites suitable for annual monitoring, and a recording system for beached seabirds. At the end of this contract he went to Brittany to help with studies on seabirds caught up in the Amoco Cadiz wreck,

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followed by work in Pembrokeshire when the Christos Bitas was grounded. He then spent three years based in Aberdeen as part of a four-man NCC Seabirds at Sea team. They spent as much time at sea as possible; in Peter's case, this included five weeks on a rig attached to Brent Bravo in Autumn 1979. His observations on bird migration seen from the rig were published in British Birds.

In 1982 an attack of endocarditis (probably linked to rheumatic fever in his youth) left him hospitalised for some weeks, and he returned to Prestatyn to recuperate. The following year he moved to Menai Bridge where Bangor's research vessel Prince Madog was based and took part in counts of seabirds and cetaceans in the Irish Sea. Peter married Joan Lewis in 1985. He also spent much time on Ynys Enlli (Bardsey), including 12 months during 1984-85. He had been an obsessive collector of references about Bardsey since 1959 and edited the Bird Observatory's Report from 1970 to 1999. Whilst on the island, he worked on The Natural History of Bardsey, which was published by the National Museum of Wales in 1988. It remains the best general introduction to the island's wildlife. Ten years later Gomer published Between Sea and Sky, a superb collection of Peter's photographs from Bardsey; accompanying each is a quotation from the poetry of his friend R.S. Thomas, who was Vicar of Aberdaron and visited Bardsey frequently.

In Spring 1986 Peter began a project for the RSPB on the status and ecology of Black Grouse in Wales, using a base near Bala. After writing up the following year, his health prevented him from continuing, because of the arduous fieldwork involved. In October 1987 he enrolled in the College of Librarianship in Aberystwyth (as the oldest in a class of 80 students), and in 1990 submitted a Master's thesis on the feasibility of creating a wildlife database for Wales. By then, he had rejoined NCC in Bangor as Monitoring Ecologist, and set up a team of a dozen workers for what became CCW's monitoring programme. He pioneered the use of fixed-point photography, developing a technique which captured the subtleties of habitat change and demonstrated his photographic skills and eye for detail.

In 1988 the Welsh Ornithological Society was formed and Peter was its first Chairman. He resigned, for personal reasons in 1990.

In 1993 heart surgery became necessary; after a pacemaker was installed, he finally retired in 1994. By then he and Joan were happily ensconced in The Hide, a small house in Menai Bridge. Retirement allowed him to continue writing, including (with Ian Bonner) a Contribution to the Flora of Bardsey published by CCW in 2002. His next project - Birds of Anglesey, Adar Môn - (with Paul Whalley) finished up as a very large book. In 2001 in an article published in the then new wildlife journal Natur Cymru he wrote about the spirituality of nature reserves such as Bardsey, which for him was a product of ethics and human consciousness rather than theistic religion. He argued that nature reserves could add immeasurably to human well-being as sources of beauty and naturalness.

Perhaps it came a little too late, but presentation (by Iolo Williams) of a Lifetime Achievement Award from the Welsh Ornithological Society in 2012 was very appropriate. The citation mentioned his work on seabirds, including monitoring oiling disasters, and a total of 148 publications; it finished by referring to him as 'this most modest of men'. Incredibly hard-working, conscientious well beyond the call of duty, he was great company and an inspiration to friends and colleagues. His achievements were limited only by the number of hours in the day and, sadly, by bouts of illness.

Joan died in 2014. He is survived by his sister Margaret (Marty) and his brother Ron.

Geoff Gibbs